VOLUME 68 • AUGUST 1958 • NUMBER 2

A.M.A. ARCHIVES OF

OTOLARYNGOLOGY

The Future of Otolaryngology
Herman I. Laff

The Training of Future Otolaryngologists
Harry P. Schenck

Clinical Evaluation of Cortisporin Otic Solution
Wallace Rubin and Jack A. Anderson

Transantral Decompression for Malignant Exophthalmos
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Nomenclature and Staging of Malignant Tumors of the Larynx and of the Hypopharynx
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A. M. A.
ARCHIVES OF OTOLARYNGOLOGY

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Checks, money orders, and drafts should be made payable to the American Medical Association, 535 North Dearborn Street, Chicago 10.

AMERICAN MEDICAL ASSOCIATION Publication

Published monthly by the AMERICAN MEDICAL ASSOCIATION. Editorial and Circulation Offices: 535 North Dearborn Street, Chicago 10, Illinois. Publication Office: Thompson Lane, Box 539, Nashville 1, Tennessee. Change of Address: Notice to the circulation office should state whether or not change is permanent and should include the old address. Six weeks' notice is required to effect a change of address. Second-class mail privileges authorized at Nashville, Tenn., Aug. 6, 1956.

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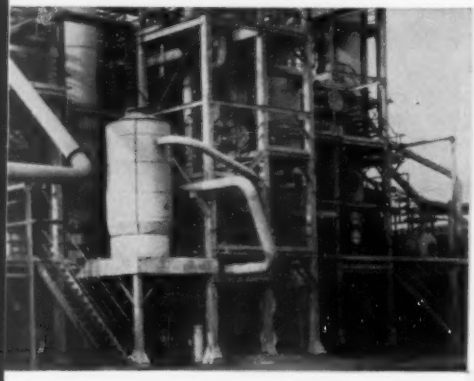

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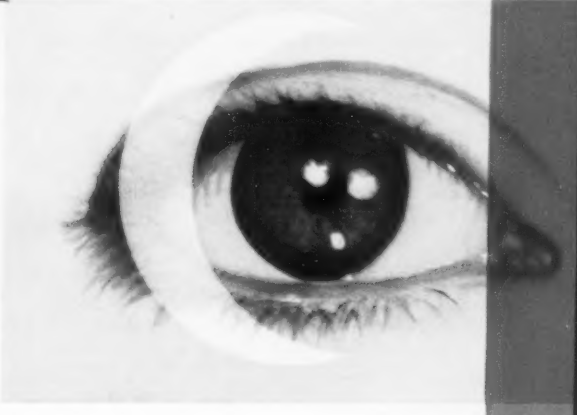

References

1. King, J. H., Jr.; Passmore, J. W.; Skeehan, R. A., Jr., and Weimer, J. R.: Tr. Am. Acad. Ophth. 59:759, 1955.
2. Kuhn, H. S.: Tr. Am. Acad. Ophth. 55:431, 1951.

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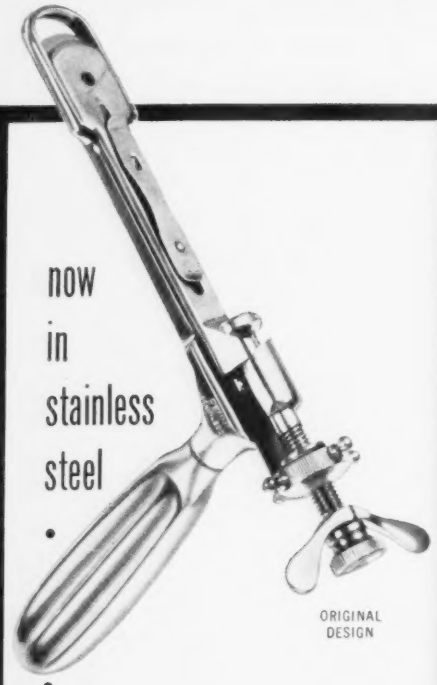

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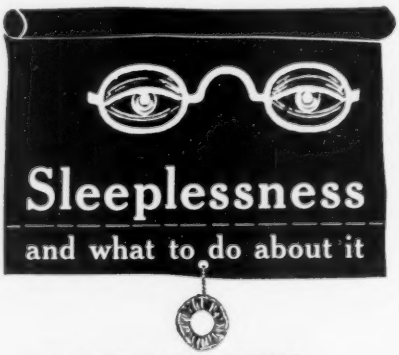

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A.M.A. ARCHIVES OF
OTOLARYNGOLOGY

At the last meeting of the Teachers' Section of the American Academy of Ophthalmology and Otolaryngology in October, 1957, a spokesman for the American Board of Otolaryngology announced the decision of the Board to add a fourth year of residency training, to be spent in general surgery, to the requirements for examination for certification in the specialty. A good deal of unfavorable comment from those attending the Section meeting was brought out, and this has led to the presentation and acceptance for publication in the ARCHIVES *of the two following papers.*

These two papers present two main viewpoints in the discussion of this question, both pro and con. Dr. Laff's paper was approved almost unanimously for publication by the Editorial Board of the ARCHIVES, *and informally by many members of the American Board.*

The object of the ARCHIVES *in publishing these two papers is to bring the whole subject up for general discussion, that the whole issue may be clarified, the reason for the additional year of residency may be better understood than it appears to be at present, and the change approved, or disapproved, by the members of the specialty. It is not the policy of the* ARCHIVES *to take part officially in this discussion, but to help in clarifying the issue.*

The American Board of Otolaryngology will hold a meeting in the Palmer House, Chicago, Oct. 10, 9 a. m., to hear objections to the four-year plan. Any organization or individual wishing to voice objections will please write to Dr. Dean Lierle, Iowa City, Iowa, Secretary of the Board, for an appointment to attend this meeting.

GEORGE M. COATES, M.D.

The Future of Otolaryngology

HERMAN I. LAFF, M.D., Denver

The well-attended Teachers Section of Otolaryngology at the recent Academy Meeting in Chicago provided some explosive expressions which should give us all food for thought. The announcement of the Residency Coordinator that a fourth year in general surgery would be added to the present three-year requirement for training in otolaryngology after 1960, came as a bombshell. The preponderance of opinion elicited was that this was untimely, unrealistic, and ill-advised. The applause that followed definitely indicated where the majority stood. In the group discussions after the meeting, opinions were even less restrained. Why should the occupants of these "ivory towers" make such far-reaching decisions without first sampling the opinions of the rank and file? Don't we all have a vital stake in the future of our specialty?

It appeared that the democratic process had broken down in this phase of the Academy's influential activities.

The Chairman of the Teachers Section, it should be stated, although himself in favor of a fourth year, pointed out that its revocation was still feasible if logic and expediency so dictated.

The purpose of these remarks is to urge abandonment of this new regulation. The temptation to bring into focus other tenuous trends besetting our specialty, and if possible, point out means to avoid them is difficult to resist.

First let us examine the purpose and urgency that created this fourth-year addition to our residency curriculum.

Submitted for publication Nov. 22, 1957.

Presented at a meeting of the Colorado Otolaryngological Society, Nov. 2, 1957.

There are those who have strongly maintained that otolaryngology should be expanded to embrace the total field of head and neck surgery. In order to meet the criticism of inadequate qualifications leveled at us by the general surgeons, our spokesmen have become increasingly anxious to provide a fourth and later perhaps a fifth year of training.

This might be acceptable if prospective residents were knocking at our doors. Unfortunately, recent American graduates shy away from otolaryngology, although its needs remain pitifully unfilled. The increased training demand could prove disastrous, especially in view of the widely disseminated myth that otolaryngology is a "dying specialty." The effort to broaden its base has brought it into conflict with related surgical fields, particularly head and neck oncology. Are these excursions toward radical surgery distorting our thinking to our own detriment? Is it necessary or even desirable that every future otolaryngologist in every community, large or small, become a master surgeon of every complicated head and neck procedure? Would it not be more logical to let those who are drawn to this work seek the necessary training and perfection *following* their residencies? Precedents for this, for example, have been quite common in qualifying for fenestration and nasal reconstruction surgery.

Next let us examine what a fourth-year addition really means. Some feel that it could be wasted in many instances, economically and medically. Many trainees would of necessity affiliate with hospitals having only mediocre surgical programs. Certainly holding retractors and the like would not provide useful backgrounds for training in endoscopy, laryngeal surgery, fenestrations, and microsurgery of the middle ear. Except in university and allied institutions, hospitals meeting adequate qualifications would appear relatively few in number.

Admittedly some of the best residency training has been provided by those university centers whose heads have been the proponents of this new plan. Perhaps they have been unduly influenced by their own successes in their autonomous, well-controlled and well-staffed departments. Most probably they have not experienced the trials and frustrations in dealing with heads of surgery departments.

We should remember that general surgery also is a field experiencing encroachment and attrition. What it still holds onto it is not about to relinquish.

Many of us will not agree with the assumption that, say in 10 years from now, departments of general surgery will have lost much of their present stature and influence, so why not placate them for the present?

However, the chairman's report of withdrawal of residency accreditation from several university hospitals elicited much greater concern. My own experiences with the Residency Review Committee's withdrawal of recognition at the University of Colorado impressed me that the Committee was attempting to apply pressure—albeit in a vague sort of way—to turn over to the division of otolaryngology the head and neck surgery. The wisdom of this precipitous action in our circumstances was certainly open to question. It proved exceedingly prejudicial and devastating to the morale of our voluntary staff, almost to the point of disintegration. It would seem that resort to this harsh approach in face of the present uneasy future of otolaryngology is a luxury that we can ill afford.

Now let us examine what some of the effects would be if the contemplated program were put into practice.

No doubt, many residents trained under the best programs soon would seek clinic or university affiliations. The others would gravitate to the larger cities. The smaller communities capable of supporting otolaryngologists generally would be by-passed. Admittedly they too are entitled to our help if medicine is to fulfill its obligations. Can we by our increased training demands and

economic road blocks afford to discourage young otolaryngologists from settling in these smaller towns? Is not their dwindling supply today, even in many of our larger centers, an uncomfortable situation, to say the least?

The solution to these glaring defects cannot be postponed indefinitely. Some fresh approach must be evolved. The following suggestions, although not new, are worth considering. If implemented they could strengthen our usefullness generally and help breathe life into our specialty.

The three-year residency program as presently constituted, including head and neck surgery and bronchoesophagology should, of course, be encouraged. For the present the proposed fourth year requirement should be revoked. Greater stress should be placed on *pure* laryngology, rhinology, and otology. Let the Board of Otolaryngology examine and certify for these primarily. Insist on sharing bronchoesophagology with the chest surgeons as the latter cannot be denied their interest in this field.

Radical head and neck surgery requires special training and should be controlled separately. In other words, get as much as possible for otolaryngology but require of those who are really desirous of becoming full-fledged head and neck surgeons to seek and obtain the necessary training and experience to qualify for special board certification. Actually, subspecialization in otolaryngology has long been a reality and no doubt is destined to grow. Is this not anomolous in a "dying specialty"?

Now may I advocate what by some would be regarded as a throwback to the limbo of the past—the reinstatement of preceptorships in otolaryngology. Some of the reasons pointing to this need already have been mentioned.

Let us encourage young men out of their internships to associate themselves with busy and competent otolaryngologists. This undeniably again would arouse interest in our field. Preferably such association would be more desirable after a basic science course, say of nine months. Let us give due credit for preceptorship training toward certification as was the vogue up to a few years ago. Whether additional residency training should be required can be decided later. Examination and certification, however, should be in pure otolaryngology.

We should not be too disturbed by the fear of unqualified men overstepping their limitations. We now have control committees in our hospitals who will not long countenance glaring mediocrity.

Preceptorships also will help correct a defect which has crept into ear, nose, and throat practice in recent years—that of obtaining assistants for mature, overworked otolaryngologists. In a "buyers'" market they find it difficult to compete with clinics offering $15,000.00 to $20,000.00 yearly salaries to residents just out of training—what with their fringe benefit plans, etc., dangling as added bait.

It would seem that in our eagerness to raise standards we have unwittingly allowed this unhealthy situation to arise, destined certainly to cut the life span of many of our self-sacrificing, aging confreres—whom in the present state of shortages we can ill afford to lose.

The specter of state-controlled medicine, of course, here raises its ugly head. If we fail to meet the demands justly expected of us, government will certainly step in. Our controlling boards must help the profession meet the public's needs for good medical care.

In conclusion, let us realize that otolaryngology is at the crossroads. Its leaders should give heed to the crescendo of unrest gaining volume from its "grass roots." The time is here for some soul searching and an agonizing reappraisal of our goals.

The concepts herein advocated have served us quite well in the past. Whatever prompted their abandonment, let us not

hesitate to revive them. Let us reinstate preceptorships in otolaryngology and attempt to recapture some of the man power we have lost.

Finally, let us stop reaching for the moon. For the present we had better keep our feet on the ground and rededicate ourselves to that type of medical care we alone are best qualified to give.

If, as some insist, the metamorphosis of otolaryngology into a head and neck specialty should be our ultimate goal, it would now seem that this is not destined generally to be implemented except by orderly and sustained evolutionary methods. Attempts to force its acceptance prematurely may cause it to die aborning.

Metropolitan Building (2).

The Training of Future Otolaryngologists

HARRY P. SCHENCK, M.D., Philadelphia

The training of future otolaryngologists is a pressing and immediate problem. Not only is there a dearth of young otolaryngologists, but the demand for those terminating their residency training in approved institutions has become so competitive as to result in offers of fantastic salaries and many other tangible benefits. In fact, these offers have become so attractive that the future teachers and research workers in the specialty are being lost permanently at a time when there is the greatest need for them.

It is paradoxical that, after two decades of unprecedented expansion and scientific advancement in our specialty and with the demand for trained otolaryngologists far exceeding the supply, there should be so few medical students and interns planning to embark on a career in otolaryngology or one of its numerous subspecialties.

At the root of the problem is the fact that instruction in otolaryngology in many of our undergraduate medical schools has been relegated to the fourth year and limited to a few didactic lectures and several hours spent in the outpatient department. This is not only inadequate but too late to influence the future course of the medical student who, by this time, has usually decided upon his subsequent field of activity. Moreover, many of these students are entering internship totally unprepared to cope with problems which concern 35% to 40% of their future patients.

It is of vital importance that the unprecedented opportunities and even the financial rewards of a career in otolaryngology be brought to the attention of the medical student in the early years of his course. This can be accomplished only if otolaryngologists take an active part in the planning of the curriculum of the undergraduate medical schools and assume equal responsibility with the other members of the faculty. The specialties should have representation on curriculum committees in order that instruction in basic sciences and the proselyting for undergraduate research activity receive adequate emphasis without defeating the primary purpose of the medical schools —to turn out well-rounded and versatile physicians.

The development of a strong undergraduate program in otolaryngology is essential not only for the adequate training of medical students but also for the stimulation of their interest in subsequent training as residents.

In advocating some instruction in otolaryngology in each of the four undergraduate years, it is only equitable that most other clinical subjects be afforded a similar opportunity. As far as otolaryngology is concerned, two hours of correlation lectures in otolaryngology during the first year serve as an introduction to the specialty and at the same time emphasize the application of basic science in clinical practice. During the second year, a minimum of four hours of physical diagnosis in otolaryngology familiarizes the student with the use of the head mirror, specula, and other instruments.

Submitted for publication April 18, 1958.

Presented before the New York Society of Otology and Laryngology, New York, March 3, 1958.

The opinions expressed in this article are not necessarily those of the American Board of Otolaryngology, the American College of Surgeons, or the American Medical Association.

Free use has been made of the opinions and suggestions of John F. Daly, M.D.; Frederick T. Hill, M.D.; Paul H. Holinger, M.D.; Dean M. Lierle, M.D.; James H. Maxwell, M.D., and Theodore E. Walsh, M.D.

and prepares him for the examination of patients during his next two clinical years. A minimum of 24 hours during the third year for didactic and bedside instruction and full-time assignment to the department for two to three weeks during the fourth year are essential for the broad clinical training to which the future physician is entitled. In those medical schools where this or a comparable teaching program in otolaryngology has been introduced there has been a significant increase in the number of applicants for residency training in the specialty.

Internship follows graduation, and the present policy of one-year rotating internships is receiving widespread criticism. Because of the multiplicity of services in the modern hospital it is obviously impossible to rotate each intern through every service in a single year. This results in major variations in clinical experience among interns in the same institution. Moreover, the assignment to each service is too brief, the experience obtained too superficial, and the burden of routine hospital paper work too heavy to permit the forming of sound professional habits. In contrast are the many advantages inherent in the straight internship in one of the major fields.

The aim of the residency program in otolaryngology should be to provide the resident with the knowledge and experience necessary to practice good otolaryngology, to stimulate him to a continuing program of education, and, if desired, to further training in any of the subdivisions of the specialty. No rigid program for residency training will prove appropriate for all institutions or best develop all who are exposed to it. Nevertheless, some common denominator must be agreed upon as a basis for all training programs.

A prime requisite for planning any training program in otolaryngology is a clear concept of the scope of the specialty. The confines, as clearly described 50 years ago, are completely valid today, and significant extensions or limitations are unlikely in the forseeable future. Dr. Joseph C. Beck described these confines as follows *:

A few years ago one could have answered this question very easily by enumerating the various conditions commonly treated within the nose, pharynx, larynx and ear, but in recent years, this special field has gone beyond these confines. Slowly but certainly have they advanced, and today modern otolaryngology comprises the capital operations of the head and neck.

There still exists considerable hesitation in our ranks regarding this progress and extension, feeling the possible danger of encroachment on the field belonging to the general surgeons. This, however, I believe to be a mistake, because there is a natural association between the affections of the cavities of the nose, throat and ear and their adnexa. Consequently the modern otolaryngologist should not be satisfied to confine himself to the treatment of cavities, but should also include the adnexa and the complications.

On the other hand, the limitations of otolaryngologic practice is entirely an individual matter; one may confine himself to the treatment of the nose and throat, while another will treat only the ear, another will treat them all, another only conditions within the cavities, and some will treat internal as well as external diseases of these structures, nay, go beyond and treat the structures intimately associated with them. I wish to commend the latter class, and herewith give my reasons by citing specific conditions.

First—Let us take a case of nasal obstruction in which a diagnosis of fibrosarcoma is made. It involves the entire half of the superior maxilla, and it is necessary to do a temporary or permanent resection of the superior maxilla with or without ligation of the carotid artery. It has been the practice to call in a general surgeon to do this operation which I claim is entirely within the domain of otolaryngologic practice.

Second—An acute or chronic accessory sinus affection develops definite brain symptoms; a diagnosis of brain abscess or meningitis is made as a complication. The rhinologist has performed the intra- and extra-nasal operation of the sinuses, but the exploration of the brain or puncture of the spinal canal has been left to the general surgeon. There is no reason why the complete operation should not be performed by the oto-rhino-laryngologist.

Third—The many varieties of external nasal deformities have been and many still are being operated on by general surgeons, notwithstanding

* Beck, Joseph C.: Limitations of Oto-Laryngologic Practice, Vice-President's address, Transactions of the American Academy of Ophthalmology and Otolaryngology, 1908, pp. 7-10.

the fact that in most cases intranasal surgery is required also in order to obtain the very best results. It is, therefore, clear that these cases belong to the care of an oto-rhino-laryngologist.

Fourth—The lips, gums, jaws, palate, salivary glands and ducts, cheeks and tongue are being treated in a miscellaneous manner, some by the general surgeon, some by dentists or what are known as oral surgeons or stomatologists, and some by the oto-rhino-laryngologist.

I wish now to mention some specific pathological conditions of these structures: (*a*) Of the lips—harelip, congenital staphyloma, neoplasms, inflammatory diseases and angioneurotic edema. (*b*) Of the gums and jaws—epulis and other neoplasms, paradental and dentigerous cysts, fractures and dislocations, periostitis, abscess and necrosis. (*c*) Of the palate—cleft palate and other congenital defects, paralysis, neoplasms and inflammatory diseases. (*d*) Of the salivary apparatus—salivary calculi and cysts or ranulae, inflammation, abscess and neoplasms of the gland proper. (*e*) Of the cheeks—leukoplakia, neoplasms and inflammatory diseases. (*f*) Of the tongue—black tongue and other keratoses, tubercular and syphilitic diseases and other inflammatory affections, congenital shortening or absence of the frenum, otherwise known as tongue-tie, neoplasms.

Fifth—In recent years, it has been clearly shown that lymphatic structures of the mouth, nose, nasopharynx, pharynx and larynx drain into the various glandular regions of the neck, and their enlargement or infection is in direct proportion to the infection of these lymphoid structures within the cavities. Conversely, with the clearing up of the primary infection, the glandular disease will disappear. It, therefore, becomes clear that enlarged lymph nodes, no matter from what source, that drain the above-mentioned lymph structures come within the scope of the management of the oto-rhino-laryngologist. It is not at all rare to find cases of glands of the neck that have been enlarged for some time—if they have not as yet suppurated—disappearing as soon as the tonsils or adenoids are removed. It is also not rare to find recurrence of the enlarged glands of the neck after they have been removed, sometimes two or three times, only ceasing to return after tonsils or other infected structures within the cavities have been removed.

Sixth—A very frequent complaint of difficulty of swallowing and breathing, as well as other sensations referable to the throat, is due to enlarged thyroid gland. Pressure on the recurrent laryngeal nerve may produce paresis or paralysis of the vocal cords. This pathological condition is rationally within the limits of our specialty and should receive attention more frequently by us than it does. The same may be said of any tumor of the neck, as also branchial cysts when they produce symptoms referable to the nose, throat or ear.

Seventh—The various external operations on the larynx have practically all been performed by laryngologists in the past ten years. All I wish to say in this regard is that this goes to show their ability to perform these most difficult capital operations.

Eighth—The trachea, bronchi, lungs, esophagus and stomach, in so far as examination and treatment by means of the various scopes (tubes) are concerned, are certainly within the limits of our specialty and open a great field for advanced work.

Ninth—The many operations on the external ear, as plastics and removal of neoplasms, have for some time been performed by otologists with excellent results.

Tenth—The manifold complications of a mastoid infection, such as sinus thrombosis, thrombophlebitis, brain abscess, abscess of the neck secondary to Bezold's variety of mastoiditis, and meningitis, have likewise been mastered by the otolaryngologist and have raised our standard considerably.

Eleventh—The neuroplastic operation for the cure of facial paralysis has in the majority of instances been performed by general surgeons, notwithstanding the fact that the majority of cases are either associated with severe lesions of the temporal bone or due to our effort to cure suppurative ears. Speaking from personal experience, I wish to urge every otologist, when he finds himself confronted by this unfortunate and most unhappy condition, to do this delicate, difficult but interesting surgical procedure.

Now gentlemen, that I have enumerated the most important conditions that the modern oto-rhino-laryngologist must be prepared to treat, I wish to give my reasons why they have the advantage of so doing:

(1) From the nature of the fact of constantly being trained to manipulate delicate structures, it is natural that their results should be better.

(2) In many of the mentioned operations, as the cleft palate, mouth, etc., reflected light by means of the mirror is necessary, and only those constantly trained to handle the mirror can do the best work.

(3) By confining his work to the surgery of the head and neck, especially to this limited field, he naturally becomes an expert, whereas those that have the entire body to take care of will most likely not have the opportunity to observe as many cases. Of course, this will be qualified by the number of cases anyone sees.

(4) As said in the beginning, the oto-rhino-laryngologist should treat not only the primary lesions, but also the adnexa and complications.

All they have to do is to get perfected in the technic and know well the surgical principles, because the anatomy, physiology and pathology have always been well known to them.

In meeting its responsibilities in regard to residency training in otolaryngology, the American Board of Otolaryngology must not only maintain legitimate standards of proficiency in the various facets of the specialty but also foster the development of sufficient numbers of capable young otolaryngologists to meet the health needs of the population. After long and serious consideration of each of these objectives, the American Board of Otolaryngology has notified the Chairmen of the Departments of Otolaryngology in the United States that it deems it necessary to change the requirements for otolaryngology, effective July 1, 1960, as follows: One year of general internship in a hospital approved by the Council on Medical Education and Hospitals of the American Medical Association; one year of general surgery approved by the Council on Medical Education and Hospitals of the American Medical Association, and three years of otolaryngology in hospitals approved by the Residency Review Committee for Otolaryngology. This action on the part of the American Board of Otolaryngology has received the approval of the Residency Review Committee for Otolaryngology, which has an equal number of representatives from the American Medical Association, the American College of Surgeons, and the American Board of Otolaryngology.

The factors justifying this innovation in residency training in otolaryngology are manifold, but a consideration of a few of the more important reasons will suffice for orientation.

1. Changing trends in surgical practice have particularly affected the general surgeon, who has witnessed the evolution of the orthopedic surgeon, the thoracic surgeon, the plastic surgeon, the neurosurgeon, the oral surgeon, the urologic surgeon, the gynecologist, the pediatric surgeon, and other subspecialties. In spite of this, there is no perceptible decrement in the demand for the essential services which the broad field of general surgery can provide. However, the subspecialties of surgery have assumed prerogatives and exhibited increasing ambition to extend their orbits. Organized groups have attempted to restrict surgery of the paranasal sinuses to the oral surgeon, to exclude laryngeal surgery from the field of otolaryngology, to restrict major surgery of the head and neck to those certified in general surgery, and to demand that programs concerned with major surgery of the head and neck be their sole responsibility.

The otolaryngologist can either permit these surgical procedures to drift to other subspecialties by default or demonstrate his superiority by training, experience, and ability in dealing with the surgical problems in his legitimate field. At the present time, most of the surgical subspecialties require one, two, or even three years of general surgical training in addition to the years spent in training in the subspecialty. The otolaryngologist can only excel and compete in the overlapping areas of surgery if he has training and experience comparable to that required in the other surgical specialties.

2. In a large percentage of our institutions there is a dearth of teachers in the broader aspects of ear, nose, and throat surgery. Under present conditions, competent teachers can be trained only by enlisting the aid of well-organized general surgical services in instructions in the principles of surgery and in the provision of adequate experience in major surgical cases.

3. In a pilot study, conducted within the past 10 years, one-half of the residents in otolaryngology were given one or two years of general surgery while the other half were trained in otolaryngology alone. Those with a general surgical training were invariably superior technicians and stood head and shoulders above their confreres who had received no such training.

4. It has been the experience of the subspecialties that, after the addition of the

year of general surgery to their Board requirements, there was a significant increase in the number of applicants for residency training.

The future teachers of otolaryngologists should be fully capable of instruction in all facets of the specialty and, eventually, more and more of the training in the basic principles of general surgery should become a function of the departments of otolaryngology. A determined effort must be made to develop such teachers. The financial support for those embarking on a prolonged training period prior to teaching or research is an important problem. A development which promises to augment the supply of future teachers in otolaryngology is the recent availability of certain fellowships. Postdoctoral Fellowships, administered by the Division of Medical Sciences of the National Academy of Sciences, provide special opportunities for experience in research in the basic medical sciences. They are intended for young men and women of unusual promise and ability, in the early stages of preparation for careers in academic medicine and investigation. The annual basic stipend is $3800, with additional allowances for dependents. In addition, the National Science Foundation awards Senior Postdoctoral Fellowships to persons who will have held the degree of M.D. for at least five years by Jan. 13, 1958. Approximately 25 Senior Postdoctoral Fellowships will be awarded each year to those planning additional study or research.

There is as yet no unanimity of opinion concerning the desirability of including one or more years of general surgical training in the residency training program for otolaryngology. A number of alternative plans have been proposed.

1. It has been suggested that the otolaryngologist located in towns and cities distant from medical centers practice *medical otolaryngology*, with his surgical activities limited to minor procedures such as tonsillectomy, antrum washings, myringotomy, and polypectomy. Proponents of this plan point out that improvements in transportation now enable patients to travel to large centers for major surgical procedures. They further suggest that such medical otolaryngologists require only two years of training, with emphasis on the medical aspects of the specialty.

Opponents of this proposal point out that otolaryngology is a surgical specialty and that any Board-certified otolaryngologist should be completely trained in his specialty and be trained to perform all surgery in his field, and that unless he has adequate training in his field he will not command the respect of his confreres in general surgery, medicine, and the other surgical specialties.

2. In order to augment the ranks of otolaryngologists, there are some who favor the return of the preceptorship type of training. They point out that the practice of otolaryngology is not denied to any properly licensed physician in a single state of the Union and they feel that the preceptorship system would relieve older otolaryngologists of some of their clinical burden and at the same time train young physicians to fill the need for otolaryngologic services.

Objection to this plan is based largely upon the fact that the wide variation in training, experience, technical ability, and professional interests among preceptors would result in great disparity in the type and quality of instruction afforded different trainees. Preceptorship training would deprive the student of the opportunity to compare the varying viewpoints of different clinicians, narrow his clinical horizon, and result in a restricted educational experience. Few busy clinicians are either qualified or competent to provide the instruction in the basic sciences so essential as a foundation for sound clinical practice. Under a preceptorship system there would be serious deterioration in otolaryngological educational standards and the advances during the past three decades would almost be nullified.

3. Some increase in the number of otolaryngologists may result from a third plan.

A candidate may be qualified for examination, at the discretion of the American Board of Otolaryngology, if in addition to graduation from a medical school approved by the Council on Medical Education and Hospitals of the American Medical Association, he is of known good moral caliber and ethical in his professional relationships, and has limited his practice to otolaryngology for seven years in association with a hospital staff approved by the Council on Medical Education and Hospitals of the American Medical Association. This Board provision is not new and has not been productive during the past. With few exceptions, this type of training has been highly unsatisfactory.

There is little difference of opinion concerning the optimal objectives in residency training in otolaryngology but, as the multiplicity of suggested plans testify, there is divergence of opinion in regard to the means by which these objectives are to be gained. A broad, flexible program, acceptable to the majority of those engaged in training residents, is a prerequisite for an assessment of the future needs in physical facilities and personnel. The following program may serve as a basis for future planning.

Autonomy

The future otolaryngologist should receive his training in an autonomous department, because an independent department fosters originality, resourcefulness, and progress. It is important that the department should have a separate and adequate budget and the authority to select its own staff and direct its own program.

Staff

The strength of any good teaching department is dependent upon the abilities, the resourcefulness, the imagination, the cooperativeness, the reasonable aggressiveness, and the training of the chairman and his staff. At least one or more of the staff should be full time, or at least geographically full time. This is essential to provide attendance at all times for the supervision of residents and medical students and to expedite decisions in administrative problems. Some of the staff, particularly in large cities, should consist of some part-time teachers who will meet their assignments conscientiously. Part-time instruction by otolaryngologists in private practice plays a stimulating role by providing different points of view and by imparting the art of the practice of medicine through first-hand observation. Full-time teachers should be trained in the broad scope of otolaryngology and should have fundamental training in general surgical principles prior to their training in otolaryngology. The staff should appoint a director of instruction in basic sciences who would be responsible for organizing, developing, and directing the program. Because many of the basic science programs in otolaryngology are so inadequate at present, those institutions lacking good basic science programs should obtain their residents from institutions having a well-organized basic science course or assign their residents to an acceptable course in basic science in one of the several graduate schools. Excellent graduate school courses of four to eight month's duration are available for this purpose. Finally, several staff members, interested in and actively engaged in some type of research, should be entrusted with the duty of stimulating interest in original investigation.

Clinical Material

The clinical material should be sufficient for the particular teaching demands of the institution and should be varied to include the broad scope of otolaryngology. Included should be peroral endoscopy, maxillofacial surgery, surgery of the head and neck excluding thyroid surgery, and audiology. There should be at least six in-patients available for each resident.

Physical Facilities

A good department should have the following physical facilities: A separate sec-

tion for otolaryngological inpatients, enough outpatient space for adequate training of residents and medical students as well, and provision for a seminar room and research activities. Additional space should be assigned for instruction in the basic sciences, and this should include laboratories for temporal bone surgery, animal operative surgery, rooms for dissection, and a histopathological laboratory.

Residents' Program

The program for the teaching of residents in otolaryngology should consist of four years of training following the general internship. One of these years should be devoted to general surgical training, either on a general surgical service in another hospital or the parent institution, or to more specific surgical experience provided by the cooperation of the chief of otolaryngology and the chief of surgery. At least a portion of this training should consist of instruction in the principles of surgery, actual experience in the wards and operating rooms, and some actual operating experience. The earlier in the residency training program that surgical training is given, the greater the value.

A specific program for training in general surgery for residents in otolaryngology is being studied by the Residency Review Committee for Otolaryngology in collaboration with the Board of Regents of the American College of Surgeons. The first year of surgical residency has proved its value not only to those continuing for additional surgical training but to those residents who deviate after this year to various surgical specialties, including otolaryngology.

Of great importance in institutional responsibility is the acceptance of the principle of integration of all services in the residency training program. If a resident in otolaryngology is to rotate through the general surgical service, he should have the full share of the responsibility and work of that service. His experience at that stage of his training should equal that of the surgical resident of equal status. Conversely, the surgical resident, possibly during several periods of his training, should be an accepted member of the resident staff of the department of otolaryngology. The plastic surgery resident must know how to examine the interior of the nose and must know its physiology; the thoracic surgery resident must have basic training and experience in bronchoscopic and esophagoscopic techniques, and the general surgical resident, if he is to do head and neck surgery, must not only know how to examine the pharynx and larynx thoroughly, but must also know the special pathology and the clinical course of both benign and malignant processes in this area. Cooperation among the services to develop well-rounded residents in all fields would ease the growing rivalry among services and residents.

A profitable one-year experience in general surgical training might well include two months of anesthesiology, six weeks of surgical pathology and formal teaching by lecture or seminar or both in general physiology, surgical anatomy, fluid therapy, acid-base balance, shock, hemorrhage, and flaps and grafts. The remaining time could be devoted to assistance on major surgical problems or to the performance of such procedures as biopsies, skin grafts, hemorrhoidectomies, hernioplasties, pilonidal cyst excisions, and amputations. Each first-year surgical resident usually has experience in cystoscopy and sigmoidoscopy and performs enough individual operations to acquire a great deal of adeptness in dissecting and suturing.

Residency training in otolaryngology should be progressive. The first year should be devoted to basic sciences and minor surgical procedures, with more advanced work assigned during the second and third years. It is advisable to allocate definite time for weekly journal seminars, clinical pathology conferences, and seminars by the residents on otolaryngologic problems. Lec-

tures by the sections of medicine and surgery with emphasis on allied and borderline subjects are especially valuable. The department of radiology should be entrusted with the instruction concerned with radiologic diagnosis and therapy in the field of otolaryngology, and, wherever possible, the resident should be attached to the department of allergy for a period of time. A good service schedules regular diagnostic and clinical conferences and from time to time assigns each resident to present to the staff formal papers dealing with various phases of the specialty.

Instruction in the basic sciences should be confined to those fundamental to the intelligent practice of otolaryngology and should include anatomy of the ear, nose and throat, neck, chest, esophagus, and nervous system; gross pathology and histopathology; microbiology; special physiology; didactic otolaryngology; principles of surgery; audiology; speech as related to otolaryngology, and biochemistry.

The Board has very wisely refrained from stating the method by which these subjects should be taught. However, it is suggested that, with the exception of pathology, a block period of three months be devoted to these subjects before entering the house service. The importance of pathology is such that a minimum of three months should be alloted to this subject alone during the resident's first year, and the resident assigned directly for this period of training to the department of surgical pathology in the hospital or to the department of pathology in the medical school. Each resident should be responsible for the pathological notes for his own patients throughout the entire training period.

Surgical anatomy and endoscopy on animals may be taught in the evenings during the first year to conserve the daytime hours for other activities. Refresher courses in neuroanatomy and head and neck dissection are advisable each year if anatomical material is available.

No attempt can be made to dictate times for operative procedures and outpatient procedures, as the time element differs in many institutions. Of prime importance, however, is the availability of a permanent staff member for supervision in the operating room.

Special provision should be made for those persons who contemplate a career in the subspecialites of otolaryngology, such as temporal bone surgery, maxillofacial surgery, tumor surgery or laryngeal surgery to arrange for additional training.

These are a few of the momentous problems confronting otolaryngology today. The various solutions lie solely in the hands of otolaryngologists but will require intensive study, cool deliberation, unselfish collaboration, and the preservation of the highest standards of otolaryngologic practice.

326 S. 19th St. (3).

Clinical Evaluation of Cortisporin Otic Solution

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Introduction

Numerous studies have been reported regarding the clinical effectiveness of combinations of antibiotic drugs and cortisone derivatives in the local treatment of ear infections. The purpose of our study was to determine whether a combination of antibiotics with cortisone derivatives was more effective in the local treatment of ear infections than cortisone derivatives alone. We were also interested in determining, if possible, what particular clinical conditions were best suited to such local treatment.

Material and Method

This study is based on observations made in 268 patients from both private and clinic practice. All patients were ambulatory and were seen by one or the other of us. In every case a definitive diagnosis was made; treatment was prescribed, and follow-up observations were made. The study was limited to the following types of cases: (1) diffuse eczematoid external otitis; (2) external otitis secondary to surgery; (3) suppurative acute otitis media; (4) suppurative chronic otitis media.

Two solutions were available for use, one labeled Preparation "A" containing hydrocortisone (free alcohol) 10.0 mg. per cubic centimeter in a preservative solution (thimerosal 0.1 mg. per cubic centimeter), and a number of other excipients to give it the desirable physical properties. The second solution labeled Preparation "B" contained Aerosporin brand polymyxin B sulfate 10,000 units per cubic centimeter; neomycin sulfate 5.0 mg. per cubic centimeter, and hydrocortisone (free alcohol) 10.0 mg. per cubic centimeter in the same preservative mentioned above. The coding of the above solution was not available to the investigators until the study was completed. A fixed random system was employed, for selection of patients to use either medication "A" or medication "B."

The patients had routine culture and identifications irrespective of the pathology previous to the institution of treatment. Sensitivity tests were used in only those cases which failed to respond to treatment within 72 hours. The "cogwheel" type of sensitivity test was utilized in all cases where indicated. It was not felt that routine standard sensitivity tests would contribute enough to warrant their use. It was felt that it was almost impossible to draw any valid conclusions from the standard sensitivity tests which employed minute concentration of antibiotics. For example, during treatment polymyxin and neomycin in strengths of 1.0 mg. and 5.0 mg. per cubic centimeter were used. The strongest commercial sensitivity discs contained only 0.03 mg. and 0.06 mg. per cubic centimeter respectively. Although polymyxin is usually thought of as an antibiotic with a spectrum strictly limited to a relatively few Gram-negative organisms, this is only true as long as you are discussing concentration that can be safely achieved by systemic use, (0.01 mg. per cubic centimeter). On the other hand, at levels employed topically (0.50 mg. per cubic centimeter), polymyxin is bactericidal not only to most Gram-negative organisms but to a number of Gram-positive ones as well, including staphylococci and streptococci. For this reason ordinary sensitivity tests have little or no relation to the success or

Submitted for publication Nov. 5, 1957.

Cortisporin Otic Solution (CTM 575) supplied by Burroughs Wellcome & Company, Inc., Tuckahoe, N. Y.

failure of the antibiotics when used locally or topically.

In addition, testing the sensitivity of organisms to polymyxin and neomycin separately is apt to lead to erroneous conclusions since very strong synergism and occasionally antagonism have been shown to exist between such combinations. Sensitivity tests, then, should be done with discs containing the same concentration of polymyxin and neomycin as are found in the otic preparation used. For this reason, the discs employed in the cogwheel type of sensitivity tests were those containing polymyxin at 1.0 mg., neomycin 5.0 mg. per cubic centimeter, and a third disc containing polymyxin 1.0 mg. and neomycin at 5.0 mg. per cubic centimeter.

Routine of Treatment

Each patient used either Preparation "A" or Preparation "B" according to the following directions. Six drops of the otic solution were instilled into the affected ear with the patient in the lateral lying-down position. The head was kept in this position for five minutes, after which a piece of dry cotton was placed in the meatus of the ear canal. All patients were instructed to use the otic solution in this way, three times each day. The minimum period of use of the medication was 72 hours.

Systemic medication was used in combination with the Preparation "A" and "B" when indicated. No other local otic solution was used unless the patient failed to respond to treatment within 72 hours and then was recorded as a failure in the statistical analysis. All patients were evaluated within 72 hours after the inception of treatment, and, if there was no response to the drug, sensitivity studies were then done according to the cogwheel technique. These sensitivity studies were carried out on culture specimens which were obtained before treatment was instituted.

Safety

There was only one instance in the entire series of an allergic response to either Preparation "A" or Preparation "B." In this particular case a marked allergic reaction resulted within 24 hours after treatment was begun. The patient was on Preparation "B," and the medication was stopped immediately.

Many of the patients treated in this study had used other otic solutions in the past and all had commented that one or other preparation had caused a sensation of itching or burning. In response to questioning, our patients all stated that they did not experience any such undesirable side-effects. In our experience lack of local irritation with preparations of this type is most unusual.

Results

The results of this study are summarized in the Table. Preparation "B," the one containing polymyxin and neomycin in addition to the hydrocortisone, was obviously the most effective. The exception to this was in the cases of diffuse eczematoid external otitis. We feel that one of the ex-

Results of Treatment with Cortisporin Preparations

Diagnosis	Preparation	No. of Patients	Systemic Treatment	Clinical Response			Side-Effects
				Excellent	Good	None	
Eczematoid external otitis	A	80	6	50	12	18	
	B	79	13	54	18	7	1 Allergic response
Secondary external otitis surgery	A	30	7	5	3	22	
	B	28	6	16	3	9	
Chronic otitis media	A	0	0	0	0	0	
	B	4	3	1	0	3	
Hearing aid use	A	3	0	2	0	1	
	B	1	0	1	0	0	
Suppurative acute otitis media	A	5	5	0	1	4	
	B	4	4	1	3	0	
Suppurative chronic otitis media	A	15	6	0	2	13	
	B	16	7	11	1	4	
Use during ear surgery	A	0	0	0	0	0	
	B	3	3	3	0	0	

planations for this is the fact that in all cases of eczematoid external otitis we are meticulous in periodic cleansing of the ear canal. It has been repeatedly shown that such cleansing is probably as important as any medication used.

Our clinical impression is that Preparation "B," or Cortisporin Otic Solution, as it is presently marketed, is of particular value in chronic suppurative otitis media and in external canal infections secondary to such surgery as fenestration or mastoidectomy. We have also found during and since this particular study that Cortisporin Otic Solution is valuable when used prophylactically at the time of surgery. We routinely soak sponge packs in Cortisporin Solution prior to placing them in the operative cavity. Our incidence of postoperative infection has been markedly reduced since this practice was instituted.

There was excellent cogwheel sensitivity correlation in our cases where Preparation "B" failed in treatment. In those cases of failure more than 90% failed to show inhibition of growth under the polymyxin or neomycin or a combination of polymyxin and neomycin in the cogwheel studies. Correlation was evident when the cultures and smears revealed predominant Proteus vulgaris growth which frequently is insensitive to the antibiotics. On the other hand, there was also good correlation with excellent response when Preparation "B" was used and culture and smear revealed Pseudomonas as the causative organism. There were also many instances of good response with Preparation "B" when the causative organisms were Escherichia coli (Bacterium coli) or combinations of Gram-positive cocci and some Gram-negative species.

An extremely important clinical observation was the fact that both preparations, A and B, were completely soluble and did not precipitate in the ear canal. Previous experience with other commercially available preparations of antibiotics and cortisone derivatives did not reveal such solubility. We experienced numerous episodes with other preparations where the medication precipitated in the ear canal. In an attempt to remove the caked medication the ear canal was markedly traumatized. We had no such experience in this series.

Conclusions

It is our clinical impression that Preparation B as it is marketed under the brand name of Cortisporin Otic Solution has a very definite place in the armamentarium of the otolaryngologist.

1. In the treatment of chronic suppurative ear conditions with Gram-positive cocci, and Pseudomonas and/or Escherichia coli as the causative organism.

2. In the treatment of acute or chronic diffuse eczematoid external otitis, with the above-mentioned organisms as the causative factors.

3. For the prevention and suppression of infection which is secondary to mastoidectomy, fenestration, or other otologic surgery.

305 Baronne St. (12).

BIBLIOGRAPHY

Hardy, A. B., et al.: Bacteriologic Study of Otitis Externa, 1951, 1952, 1953, Report No. 55-26, Air Force School of Aviation Medicine, Randolph Field, Texas, U. S. Air Force, April, 1955.

Herman, L. G.: An Antibiotic Sensitivity Testing Method with Mixed Bacterial Cultures, in Antibiotics Annual, 1954-1955, New York, Medical Encyclopedia, Inc., 1955, pp. 1067-1072.

Senturia, B. H.: Symposium: Medical Management of Chronic Otic Skin Infections, Tr. Am. Acad. Ophth. 58:670-676 (Sept.-Oct.) 1954.

Diffuse External Otitis: Pathogenesis and Treatment, Laryngoscope 65:313-321 (May) 1955.

Singer, D., et al.: Otitis Externa: Bacteriological and Mycological Studies, Ann. Otol. Rhin. & Laryng. 61:317-330 (June) 1952.

Pamphlet issued by Burroughs, Wellcome & Company, Inc., Tuckahoe, N. Y., on Directions for Using "Cogwheel Discs" with Aerosporin.

Transantral Decompression for Malignant Exophthalmos

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Our topic is "Transantral Decompression for Malignant Exophthalmos." As the title indicates, this is another example in the ever-widening field of otolaryngology. If the welfare of the patient is served, diversification is permissible. It is our firm belief that the otolaryngologist can offer substantial aid to the patient suffering from malignant exophthalmos.

Despite tremendous advances in diagnostic methods and therapeutic procedures available for the management of Graves' disease, exophthalmos remains its most baffling and least understood component. Differentiation into thyrotoxic and thyrotropic (malignant) exophthalmos serves a useful purpose from the clinical standpoint.

Thyrotoxic exophthalmos is a relatively mild involvement characterized by a slight "compressible" type of ocular protrusion, lid retraction, and possibly some thinning of the extraocular muscles. Except for the undesirable cosmetic effect the condition is harmless and the prognosis favorable.

Our discussion deals with thyrotropic exophthalmos (also described as malignant, progressive, or endocrine exophthalmos, hyperophthalmos of Graves' disease, etc.). It is manifested by protrusion of the eyes of a "noncompressible" type—the so-called hard orbit—associated with some or all of the following: edema of the eyelids, chemosis of the conjunctiva, engorgement of orbital and ocular vessels, paresis or paralysis of extraocular muscles, and failing vision. The prognosis in this type of exophthalmos is decidedly unfavorable. Although progression of the symptoms may halt spontaneously at any stage and the disease appear "self-limiting," serious and permanent damage can occur. The end-result may be impairment of ocular movements due to extraocular muscle changes, impaired vision resulting from optic nerve or corneal involvement, or finally actual loss of the globe from perforation and infection. Fatalities have occurred. In an excellent paper, Cordes[1] has summarized the present-day knowledge of thyrotropic exophthalmos.

Treatment of malignant exophthalmos may require medical management only or a combination with surgery. Thyroid extract, strong iodine solution (Lugol's solution), propylthiouracil, diethylstilbestrol (stilbesterol), testosterone, and corticotropin (ACTH) are commonly employed agents. Irradiation therapy to the pituitary or directly to the orbital tissues has been used frequently. Continued progression of the exophthalmos prevents closure of the eyelids and resultant exposure of the eye. These patients need surgical help.

Basically, three surgical approaches have been tried. The first attempts protection of the eye by using the lids or conjunctiva for covering. Secondly, removal of intraorbital fat tries to reduce the mass packed in the orbit. Thirdly, a true decompression is effected by removal of confining bony wall. Any of the above may be used singly or together.

Orbital decompression unquestionably has saved lives and preserved vision in a substantial number of patients. The accepted

Submitted for publication Dec. 5, 1957.

Presented at the Sixth International Congress of Otolaryngology, Washington, D. C., May 7, 1957.

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indications for surgical relief have been visual change, papilledema, or exposure keratitis. Currently the Naffziger [2] operation or Guyton's [3] modification of the lateral approach is the most popular means of decompression. The former requires a cranioplasty for removal of the orbital roof and posterolateral walls; is usually done bilaterally; is a major surgical procedure, and may result in postoperative pulsation of the eyes. Although the lateral approach is less formidable, it is still a major surgical exercise. Either method requires an anesthesiologist, assistants, and an array of instruments. Each accomplishes its purpose by removal of the confining bony wall. Neither allows the orbital contents to expand into a true dead space. The substitution of a minor yet effective operation for the same purpose should be welcome. The transantral approach with removal of the orbital floor is offered.

Our experience with transantral decompression indicates it is worthy of serious consideration and further trial. In four instances, excellent results were obtained. Hirsch [4] introduced the procedure successfully in 1929. Its rationale is sound. Generally in marked proptosis, it is predicted that an increase of 1 cc. in the effective orbital volume should allow a reduction in proptosis of about 1 mm. Removal of the orbital floor immediately increases the effective volume by an average 15-20 cc. The empty maxillary sinus offers a distinct advantage because there is no resistance to the prolapsing orbital contents. A thorough dissection and complete relaxing incisions are the keys to success.

The technique is simple and corresponds to the original Hirsch operation except for one modification described below. Local anesthesia is used throughout. A two-point blepharorrhaphy precedes the decompression. As in a Caldwell-Luc operation, the usual sublabial incision is made, the anterior antral wall exposed, and a portion removed. This allows access to the orbital floor under direct vision. A small long-handled chisel is used to fracture the bony plate (Fig. 1) alongside the infraorbital canal and around the periphery. All the bone is removed. (Hirsch left the bony canal.) The blood vessels and nerves stretch readily before

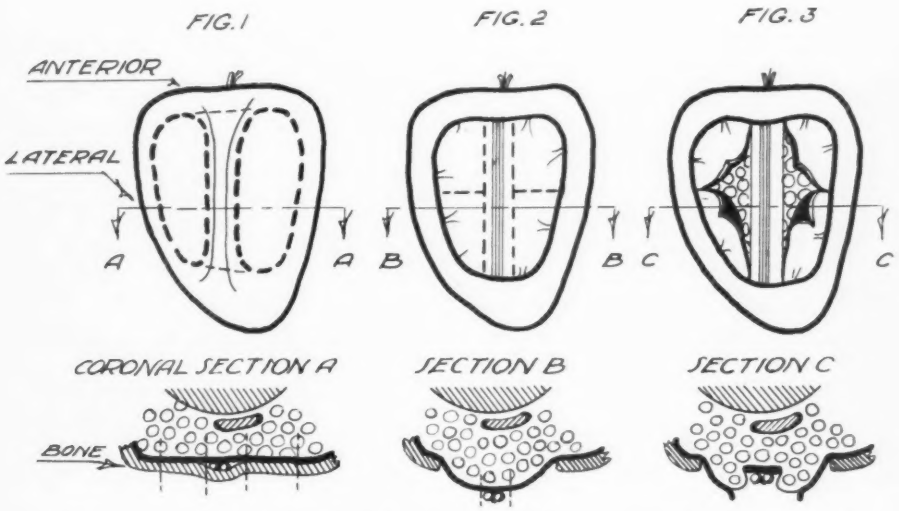

Fig. 1.—View of the right orbital floor from within the antrum, indicating fracture of bony floor.
Fig. 2.—Same view but all bone has been removed and relaxing incisions made.
Fig. 3.—Same view, demonstrating the protrusion of orbital contents into antrum.

the bulging soft tissues. Minimal bleeding is encountered. The anteroposterior incisions (Fig. 2) through the fascia divide the floor into three strips. The center strip is left intact, but each outer strip is subdivided by an incision in the coronal plane. Further relief of intraorbital pressure is thus afforded. In spite of the relaxing incisions, the orbital fat (Fig. 3) does not push out as normally observed. Instead it is found to be cohesive and must be removed piecemeal. An inferior meatal window completes the surgery. The wound is closed, and an elastic bandage with mild pressure is placed over the eyes. Prompt improvement is apparent within three days, and an almost complete recovery from the acute symptoms of chemosis, edema, corneal ulceration, and congestion of the conjunctival vessels occurs within the week. No complications have occurred. A temporary hypesthesia was caused in one instance. No enophthalmos has developed in the minimum postoperative period of four years. In the following cases, conservative therapy [5] failed to control the progressive exophthalmos. Surgical relief seemed mandatory.

Report of Cases

Case 1.—A man aged 58, was first seen in the Carle Hospital Clinic on April 23, 1951, with typical symptoms of hyperthyroidism existing the preceding six months. Medical preparation for surgery was satisfactory, and subtotal thyroidectomy was performed on May 9, 1951. He was first seen in the eye department on the day prior to surgery. He stated that his eyes had become more prominent during the previous three months. For one month there had been some blurring of vision and intermittent horizontal diplopia. The eyes appeared prominent, although exophthalmometer measurements were only 17 in each eye. Stellwag's sign was present. Visual acuity was 20/40 in each eye. Esophoria measured 11△ for distance and 6△ at 33 cm.; 1△ of left hyperphoria was observed. No definite paresis of the lateral rectus muscles was noted on ocular rotations or by the red glass test. The hyperphoria was comitant. No conjunctival or lid edema was present, nor was there engorgement of the ocular veins. The fundi appeared normal. His next eye examination was six months after surgery. He stated that his eyes had become progressively worse during this period. Double vision was constant and not relieved by glasses with base-out prisms. Orbital discomfort, ocular irritation, and congestion associated with increasing prominence of the eyes had developed. His basal metabolic rate was normal. Visual acuity was 20/50 in each eye, and exophthalmometer readings were right 19, left 18. There was marked engorgement of the ocular veins, moderate edema of the lids, chemosis of the conjunctiva, and mild paresis of both lateral rectus muscles. X-ray therapy to the pituitary was administered at this time. One month later all the previously noted findings were more marked. Lagophthalmos and mild exposure keratopathy were present. Ocular rotations in all directions were impaired, with complete loss of function of the lateral recti. The right eye was more severely involved and loss of the globe appeared imminent. Accordingly, on Dec. 14, 1951, a two-point blepharorrhaphy and a transantral decompression were done under local anesthesia. One week after surgery very little lid edema remained; chemosis of the conjunctiva had subsided; there was no corneal staining, and the right eye appeared to have receded, although measurement was impossible. Gross impairment of ocular rotations remained. The left eye became progressively worse necessitating a similar operation on Jan. 14, 1952. Prompt improvement followed. Three months after surgery the blepharorrhaphies were separated. Lid edema, ocular congestion, and chemosis of conjunctiva had subsided satisfactorily, and the corneas were normal. Exophthalmometer measurements were right 16, left 17. Improvement in ocular rotations occurred, but both lateral rectus muscles remained impaired; 2△ of left hyperphoria and 7△ of esophoria were present for distance. Visual acuity was reduced to right 20/40 and left 20/60. A mild pallor of both optic disks was observed. The basal metabolic rate was —22 and he was receiving thyroid extract daily. Little change has been noted in the past four years.

Case 2.—A man aged 50, was first seen in the Carle Hospital Clinic on March 12, 1953. Severe hyperthyroidism of three months' duration was present. A marked thyrotoxic type of exophthalmos was observed. Subtotal thyroidectomy was performed April 3, 1953. He was examined first in the eye department 12 days after thyroid surgery. Marked lid retraction was noted, and the eyes appeared prominent although exophthalmometer readings were 17 in each eye. No thyrotropic signs were present. In May exophthalmometer readings were 20 in each eye, but again no thyrotropic signs were noted. In July the exophthalmos had increased to 22 in each eye, and early thyrotropic signs were observed. X-ray therapy was administered to the pituitary. By Aug. 14 marked lid edema, chemosis of the conjunctiva, ocular con-

gestion and limitation of rotations had developed. Loss of the left eye appeared imminent. Blepharorrhaphy and orbital decompression were performed on the left side at this time and on the right side one month later. Response to surgery was excellent. Exophthalmos receded to 17 in each eye, and all lid edema and chemosis of the conjunctiva subsided. The corneas appeared normal, permitting release of the blepharorrhaphies two months after surgery. Mild impairment of both upward and downward rotations has persisted to date (1957).

Comment

Malignant exophthalmos is a serious disease which may cause permanent eye damage or even death.

Surgical decompression is recommended before irreversible vascular and fibrodegenerative changes take place. The present methods are major procedures. As a result, operative relief early in the disease may be postponed.

The otolaryngologist offers orbital decompression by removal of the orbital floor through a transantral approach. No special patient preparation is required; no special instruments are necessary, and no assistant is needed. The danger of infection is minimal, convalescence short, and no cosmetic deformity results.

Carle Hospital Clinic

REFERENCES

1. Cordes, F. C.: Endocrine Exophthalmos, Am. J. Opth. 38:1-21 (July) 1954.

2. Naffziger, H. C.: Progressive Exophthalmos, Ann. Roy. Coll. Surgeons England 15:1-24 (July) 1954.

3. Guyton, J. S.: Decompression of the Orbit, Surgery 19:790-809 (June) 1946.

4. Hirsch, O.: Surgical Decompression of Malignant Exophthalmos, Arch. Otolaryng. 51: 325-334 (March) 1950.

5. Porter, G. L., and Walker, J. S.: Exophthalmos Associated with Thyroid Disease, Ill. M. J. 107:57-61 (Feb.) 1955.

Lateral Sinus Thrombosis

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In the past several months we have encountered three cases of thrombosis of the lateral sinus at the Temple University Medical Center. This complication of chronic otitis media is not too frequently seen in today's practices; however, otologists from all over the country are reporting interesting "atypical" cases. The older otologic surgeons remember vividly the serious problem it posed, but, since acute mastoiditis is no longer a common condition, the present-day otologist has seen few of its grave sequelae that are described in textbooks and in older journals. It is for this reason we thought it well to record our experiences.

A partial survey of the literature since 1916 was undertaken to acquaint us with both past and present experience in dealing with lateral sinus thrombosis. Beginning at the turn of the century, the number of papers discussing it increased slowly until about 1938, when, in that year alone, there were 55 papers written on the subject. Then, with the advent of sulfonamide and antibiotic therapy, this topic suffered a precipitous decline in interest and it is rarely discussed in the otologic literature. In the light of our recent experience, we feel that a fresh appraisal of the diagnosis and the treatment of lateral sinus thrombosis is necessary, and it was helpful to review and critically examine many of the studies and theories that have been put forth on the subject.

Otologists realize that today's middle-ear disease is often a distinct variant from that seen in the prechemotherapeutic and preantibiotic era. We are now confronted by patients who have been treated for some time with antibiotics by referring physicians, usually generalists or pediatricians. The acute symptoms are absent, and the disease is often in a state of chronicity that is truly a "cool process." Many saprophytic organisms thrive in the milieu so produced, and the cardinal signs of complications are partially or entirely masked. Thus, we see disease that is only partially attenuated by the wonder drugs. They have been invaluable, to be sure, but when used too sparingly or blindly, they are hazardous, as we will show in Case 2. Unrealistic antibiotic therapy and the lack of appreciation of the myringotomy are predisposing factors for the cases of sudden severe complications of smoldering mastoiditis.

Among many old controversies that raged about the treatment of lateral sinus thrombosis, the question of ligation of the jugular vein on the affected side has been hotly debated. We now believe that conservatism in this instance has no place in present-day therapy. Ligation of the internal jugular vein should be done in every case of lateral sinus thrombosis, and this should be done before the sinus is manipulated. Ligation or removal of the internal jugular vein is performed with such frequency in neck surgery today that one must accept the fact that it is not a dangerous procedure and produces no important physiological imbalance. On the other hand, sequelae of embolization with fragments of clot infected by such notorious bacteria as Staphylococcus aureus, Pseudomonas, or Escherichea coli are serious indeed, and result when ligation is not performed. Modern surgical practice cannot risk the possibility of such complications

Submitted for publication Dec. 27, 1957.

Read before the Philadelphia Laryngological Society, Oct. 7, 1957.

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when a benign procedure may negate its occurrence. It has been shown that embolization cannot be prevented completely by internal jugular ligation, but the prevention of massive dissemination can be attained, and certainly the major route of spread of the pathology is obliterated.

Report of Cases

CASE 1.—A man, age 64, admitted Jan. 22, 1957, on the neurosurgical service from another hospital, with the chief complaint of left-sided headaches of one month's duration. A known diabetic, he was on dietary management alone. He had had a chronic external otitis for over 20 years, and had been treated by drops and antibiotics by several doctors, including at least one otologist. The aural discharge again became purulent two weeks before admission, and he had had chills and fever with vomiting after every meal. There was a vague history of frequent hemoptysis for the previous month.

Physical examination: The left ear canal was filled with purulent exudate. The tympanic membrane was not visualized, and a large polyp was present which obliterated the middle ear. There was a central type of facial weakness. There were no deep tendon reflexes elicited in the lower extremities. The patient was drowsy but easily aroused. The Weber test lateralized to the left, and the hearing in the left ear was markedly reduced. There were rales in the right lower lobe, moderate cardiomegaly, frequent extrasystoles, increased venous distention in the neck, and an enlarged tender liver. The temperature was normal on admission. Blood sugar—285 mg/100 ml.; blood urea nitrogen—31 mg/100 ml.; blood CO_2—18 mEq/liter. The patient was placed under the care of a medical consultant and digitalized. Diabetic management was instituted. Two days after admission, on Jan. 24, 1957, the temperature rose to 102.4 F, and he had severe chills. An ear culture revealed Proteus vulgaris, susceptible only to chloramphenicol, which was started forthwith. X-ray of the mastoids on Jan. 26, 1957, revealed a moth-eaten sclerotic temporal bone with evidence of cholesteatoma. The fever and otorrhea continued, and the cardiac and diabetic status were uncontrollable in the face of the infection. Accordingly, a mastoidectomy was performed on Jan. 27, 1957.

A postauricular incision was made, and the cortex was entered with a cutting burr, releasing a large amount of pus under pressure. When the cavity was cleaned out and the dissection continued, a massive cholesteatoma was found filling the entire middle ear, additus, and antrum. The mastoidectomy was completed, and, the dural plate partially removed, revealed healthy dura. The sinus plate was removed, and a large perisinus abscess was discovered. The sinus was then uncovered from the sigmoid knee to the bulb and incised, revealing a large abscess in an old occluding thrombus. The thrombus was removed. The ends of the sinus were packed off, and the wound was closed in the normal manner with a heavy rubber drain at the lower end of the incision.

The patient was put on a heavy chloramphenicol and sulfisoxazole (Gantrisin) regimen postoperatively. Despite this, the drainage from the ear remained profuse and foul. The culture again showed a large number of Proteus colonies. The fever continued to spike up to 103 F, and four days postoperatively the patient developed a productive cough. The expectorated material seemed similar in appearance to the material draining from the ear. Bacteriologic study of the expectorant revealed Staphylococcus aureus, coagulase-positive, but susceptible to nearly all antibiotics. An x-ray on the same day described scattered densities in the left lower lobe. A bronchoscopic aspiration was performed, and a moderate amount of thick brown secretion was removed from the left lower lobe. For the next two weeks, aggressive therapy was continued, and several bronchoscopies were performed. Cultures were taken daily, and appropriate antibiotics were administered. The clinical course improved moderately until Feb. 14, when there was a sharp temperature spike, and his condition began to deteriorate. Despite all our efforts, the patient died two days later.

Comment.—This was a typical case of the antibiotic-masked chronic otitis. When an exacerbation occurred, he had been mistakenly treated for an otitis externa, when, in reality, he had a steadily growing mastoid infection. Because of the diabetes, the cardiac problem, and the otitis complications, we were dealing with a very seriously ill patient. We feel, however, that the manipulations and drainage of the thrombosis in the lateral sinus without prior ligation may have been responsible for the multiple emboli in the lung and other parts of the body. No doubt some of the complications could have been prevented by prophylactic ligation of the internal jugular.

CASE 2.—A boy, age 12. This patient was admitted with the symptoms of severe postauricular pain, headaches, and a temperature of 103 F. He had had right otitis media since he was 6 years old, and there was impairment of hearing, with a constant foul drainage from the right ear. For some

time prior to the onset of the acute symptoms, it was known that he had an attic perforation with extruding polyps that had been removed several times. X-rays made two weeks prior to admission revealed a sclerotic right mastoid with a large area of bony breakdown simulating cholesteatoma. He was to have been operated on earlier, but the date had been extended so that he could attend a Boy Scout Jamboree.

Examination on admission revealed a large 12-year-old boy, who complained of headache, earache, and otorrhea. There was no nystagmus, nuchal rigidity, or neurologic deficits. The admission blood survey was unremarkable.

A radical mastoidectomy was performed shortly after admission. Upon opening the mastoid cortex, a great deal of pus was released. A culture was taken from this material. The abscess had completely eroded the mastoid cavity, and a great deal of cholesteatoma and granulation tissue was present. Exposure of the lateral sinus revealed pulsating pus coming from the perisinus region. The sinus was then exposed entirely and incised. There was no bleeding or purulent material encountered. A well-organized thrombus filled the entire lateral sinus. The sinus was left open, and the cavity packed with absorbable gelatin sponge (Gelfoam). The procedure was completed in the usual manner, and the patient left the operating suite in good condition.

Comment.—This case was treated successfully without ligation of the jugular. The surgical procedure followed classic lines, however, and it was in keeping with the technique described by most other surgeons.

CASE 3.—A man, age 75, was admitted Aug. 30, 1957. He was first seen in the Out-Patient Clinic with the complaint of loss of hearing in the right ear and discharge from the ear during the previous two-week period. The patient had come to the Accident Dispensary two days previously for treatment of a painful right ear which was diagnosed as otitis externa purulenta. He denied ever having had earache, otorrhea, or previous deafness. There was uncertainty as to whether or not there was a tiny perforation in the anterior inferior segment of the drum, but there was a small amount of pulsating pus in the sulcus. An audiogram showed moderate bilateral nerve loss with a considerable conductive loss on the right. He spoke of frequent right parietal headaches of moderate intensity, lasting two to three hours, and relieved by acetylsalicylic acid. There was no nystagmus, no vertigo, and no facial weakness. Because of the vagueness of the story and the age of the patient, he was admitted for study and possible surgery. An x-ray showed a large area of breakdown in the right mastoid, especially in the region of the tip. Culture from the ear was reported as Staphylococcus aureus, coagulase-positive, but susceptible to tetracycline, erythromycin, and novobiocin (Albamycin). The blood urea nitrogen was 26 mg/100 ml.; hemoglobin 11 gm., and white blood count 7700. On physical examination, the changes in the right ear described above were noted. There were, besides, a few fine basilar rales bilaterally. The prostate was enlarged and firm. The patient was afebrile for two days and then developed a mild fever, the temperature hovering at about 99.6 F for eight days. After 10 days, the otorrhea became more pronounced, and a definite perforation could be visualized in the ear drum.

On Sept. 12, 1957, a mastoidectomy was performed, using the endaural approach. As soon as the periosteum was elevated, a large amount of creamy foul pus burst through the cortex and was followed by copious pulsatile bleeding. The rest of the cortex was quickly removed, and a very large cavity was exposed that included the entire mastoid tip, and extended to the sinodural angle. The walls of the cavity were oozing freely, and no definite source of bleeding could be seen. The cavity was packed off with absorbable gelatin sponge, and the rest of the mastoidectomy completed. The packing was then removed, and the necrotic friable bone and detritus was scooped out with large mastoid curettes. When the cavity was relatively clean, it was evident that the entire sigmoid portion of the lateral sinus had been destroyed by infection. The cerebellar plate was completely eroded, and the dura was exposed but appeared intact. The medial osseous wall of the mastoid tip was absent. In the regions of the jugular bulb and superior knee of the transverse sinus, there were clumps of beefy red granulations which appeared to fill the ends of the sinus. The tissue seemed to resemble a malignant growth. A biopsy by frozen section was done, which was reported as chronic granulation tissue. During the surgery, 1100 cc. of blood were lost and replaced in the operating room. The patient was returned to his room in good condition.

The first 36 hours after surgery were uneventful, but late on the afternoon of the second postoperative day, he had an episode of severe right chest pain, cyanosis, dyspnea, and shock. An electrocardiogram showed many supraventricular and ventricular beats. There were coarse rales at the right base but fine moist rales bilaterally. The pulse was elevated to 120-130 per minute. The impression was pulmonary infarction with cardiac failure. He was rapidly digitalized, and a right internal jugular ligation was performed. The next day he developed bilateral calf tenderness, and he was heparinized with the advice of the medical consultant. This was continued for five days, then stopped because

of subgingival hematomas forming beneath his dentures, making it impossible for him to eat. Bleeding from the ear became bothersome, but not dangerous. During the acute episode, his temperature had risen to 103 F twice, but rapidly subsided and remained normal. Cultures from the wound were proved to be Staphylococcus aureus, tetracycline-susceptible. The latter was added to the antibiotic regimen, and packed red cells were given in three daily aliquots of 250 cc. Whole blood, 150 cc., was given daily for another three days. The only distressing sign in his convalescence had been a steadily climbing blood urea nitrogen, which on Sept. 27 was 60 mg/100 ml. The Urology Department investigated this problem and felt that it was due to obstructive uropathy caused by multiple urethral strictures and prostatic hypertrophy. The ear cavity was clean, with very little drainage.

Comment.—This elderly man, who appeared to be quite robust, had been harboring a destructive otogenic process for an unknown period of time. It is said that senility deprives some patients of much of their pain sensation, and this may be the reason for his nearly asymptomatic course. Again, manipulation before ligation caused a great increase in morbidity. It is significant that the process was stopped by ligation. The part that anticoagulants played in this case is difficult to assess, and since this is a very uncommon condition today, there will probably be too few cases from which to make adequate deductions of its true value.

Conclusions

1. Otitis media, treated by haphazard antibiotic therapy and with the abandonment of myringotomy, may develop into a relatively asymptomatic chronic course complicated by serious intracranial extensions, notably thrombosis of the lateral sinus.

2. Otologists must assume responsibility for publicizing this point of view and must keep their own index of suspicion high when evaluating the "chronic running ear."

3. Treatment of mastoid disease should follow the rules of thumb laid down by John McKenzie Brown [1] over 20 years ago, to wit: (*a*) remove the existing pathology; (*b*) attain adequate drainage of the infected area; (*c*) prevent dissemination of the disease.

4. Specifically, we feel that the patient who exhibits symptoms or signs of lateral thrombosis, or in whom a thrombus is discovered at operation, is far better served by having his jugular vein ligated early in the course of surgery. Our present concept is that if the vein, when exposed, has any abnormal appearance, the most conservative management consists of ligating the vein before going further and possibly dislodging an embolus into the general circulation. Many writers have described a deceptive mural thrombosis, which may not be palpable but whose presence nevertheless may be suspected by clinically evident phlebitis. Since jugular ligation is a benign procedure, it seems wise to use it as a preventive measure even though there will be cases for which it will be shown to have been unnecessary.

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REFERENCE

1. Brown, J. McK.: Panel Discussion: Thrombosis of the Lateral Sinus, Tr. Am. Acad. Ophth. 42:404, 1937.

Nomenclature and Staging of Malignant Tumors of the Larynx and of the Hypopharynx

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At the Fifth Pan-American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology held in April, 1956, we presented a paper on the "Classification and Staging of Cancer of the Larynx and Hypopharynx," in which we tried to apply the recommendations of the International Union Against Cancer (I. U. A. C.) to the work that the *Comité Latino-Americano para el Estudio del Cancer Laringeo* had been doing since 1950 for the classification and determination of the clinical grade of malignancy of these tumors.

If we have not yet published this work, it is because we felt that discussion of the subject until now was not sufficiently spread among American specialists, and we preferred to wait until we had solved the largest possible number of points under controversy even by our Committee.

Now we have reached a satisfactory agreement, and wish to publish our present points of view in the belief that our paper could serve as a basis for further discussions, which could be started after the organization of the International Committee for the Study of Cancer of the Larynx, planned for this year.

Need for a Clinical Classification

The specialists assembled at the First Pan-American Congress (January, 1949), acknowledging the necessity of determining general rules of documentation for the establishment of statistics which would allow a comparison between the different methods and techniques for the treatment of cancer of the larynx, assigned to Prof. Justo Alonso the task of organizing a permanent Committee for the Study of Cancer of the Larynx.

That Committee, composed of laryngologists, anatomopathologists, and radiotherapists, immediately recognized the need for a classification of the different malignant tumors of the larynx, and for the determination of the stage of evolution of each case at the time of examination, and before any treatment is to be started.

Except for a few changes, the Committee was following the "Classificação do estadio evolutivo das neoplasias" by Roxo Nobre (1948) and was already working with what we could call "first essays on classification," when, in 1953, the basic codes and general rules established by the W. H. O. were made known.

W. H. O.'s main recommendations were the following:

1. To separate clinical cases by the characteristics of primary lesions and of metastases.

2. To adopt a certain number of symbols to represent the local extension of the *primary tumor* (T), the aspect of the *regional adenopathy* (N), and the *distant metastases* (M).

3. To establish a clinical classification in four *Stages of Evolution*, by considering the characteristics of the three elements mentioned above.

4. According to the *local extension* and infiltration of the primary lesion, tumors would be classified in four different groups, taking on the following symbols:

T_1—Tumor strictly confined to the organ and of relatively small size.

T_2—Tumor limited to the organ of origin, but of relatively large size, or with partial extension beyond the original organ.

T_3—Tumor with wide infiltration, reaching neighboring organs.

Received for publication Aug. 29, 1957.

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T_4—Tumor with considerable involvement of adjacent tissues and having spread to neighboring organs

5. Secondary sites would be represented by one of the three following symbols:

N_a—No palpable nodes

N_b—Movable nodes

N_c—Fixed nodes

M—Distant metastases

We cannot follow these recommendations, as we believe that they lack accuracy in gradation, and the expressions "tumor with wide infiltration" and "tumor with considerable involvement of adjacent tissues" are confusing and could mean the same thing.

Also, we do not see any advantage in using small letters for symbols representing regional metastases.

The I. U. A. C. tried to follow the above recommendations, but in the 1956 draft proposed the classification which we transcribe here, although it is in complete disagreement with W. H. O.'s recommendations, so as to allow an easier comparison with the classification we shall present further on.

Stage I—Tumor limited to mucous membrane (full mobility of the larynx retained)=T_1; no palpable nodes=N_a

Stage II—Tumor infiltrating, but not extending beyond larynx (mobility of larynx impaired or lost)=T_2; no palpable nodes=N_a

Stage III—Tumor extending beyond larynx; no nodes palpable, or nodes palpable but movable =T_3, N_a, N_b, or tumor as in Stages I and II (T_1 or T_2) but nodes palpable and movable=T_1 or T_2, N_b

Stage IV—Involvement of skin; no nodes palpable or nodes palpable but movable=T_4, N_a, or N_b, or tumor as in Stages I, II, and III (T_1, T_2, or T_3) but nodes fixed=T_1 or T_2 or T_3 N_c, or distant metastases=M

Nowadays, we acknowledge that to classify and make the prognosis of a cancer of any origin, it is particularly important to determine its location as accurately as possible and to verify the existence or not of possible regional or distant metastases.

We are quite aware that, even among anatomists, there is no perfect agreement as to the limits of the organs pertaining to the upper respiratory and alimentary tracts, and that this lack of precision is responsible for the difficulties still existing in the classification of lesions developing in neighboring regions.

However, as the majority of the malignant tumors of these organs originate in the mucous membrane lining their inner surface, we thought of subdividing the endolarynx and endopharynx into different regions. These would include structures which, because of the diversity in which their anatomical elements are arranged, favor the faster or slower extension of the malignant lesion and the more or less early appearance of regional or distant metastases.

Limits of the Endolarynx and Endopharynx

Classically, the upper limit of the endolarynx is considered to be the line separating the laryngeal and pharyngeal aspect of the pharyngeal orifice of the larynx.

This orifice is formed by the free portion of the epiglottis, aryepiglottic folds, and interarytenoid folds.

The lower limit of the endolarynx corresponds to the lower border of the cricoid cartilage.

The hypopharynx, which is the region of the pharynx of greatest interest for this paper, has as upper limit the pharyngoepiglottic folds and the lines which, following the direction of those folds, meet at the posterior wall of the pharynx. The lower limit corresponds to the plane passing by the lower border of the cricoid cartilage.

We have tried to divide the endolarynx into three regions: *epilarynx*, *mesolarynx*, and *hypolarynx*, according to the nomenclature which has been used for the pharynx (epi-, meso-, hypopharynx). However, like other laryngologists, we came to acknowledge the advantages of separating in a special group the tumors originating at the pharyngeal orifice of the larynx, and were therefore forced to admit an intermediate region, including part of the endolarynx and endopharynx.

Disregarding anatomical precision, unnecessary in this clinical classification, we can, through laryngoscopy, radio- and tomograms, easily draw the limits of these regions as well as of their subdivisions, which we called "zones."

The intermediate region (crown region or "région de la margelle") corresponds to the free portion of the epiglottis, to the aryepiglottic folds, and to the arytenoids.

In Diagrams I and II, Figure 1, the intermediate region is colored light green; the epilarynx is colored red; the mesolarynx yellow, and the hypolarynx blue. We also see in these diagrams the lines which approximately delimit those regions, and which were traced as follows:

AB passes through the crossing point of the image of the greater cornua of the hyoid bone with the line corresponding to the laryngeal aspect of the epiglottis, and runs to the posterior limit of the ventricle. This line marks off approximately the lower limits of the intermediate region.

CD, passing through the lower border of the cricoid cartilage, gives the lower limit of the hypolarynx, as well as of the hypopharynx.

EF, passing through the middle of the anterior border of the thyroid cartilage, and by the upper border of the cricoid, gives the lower limit of the epilarynx.

GH, passing by the lower portion of the anterior border of the thyroid cartilage and by the upper border of the cricoid cartilage, gives the lower limit of the mesolarynx.

In Figure 2 we see the line *IJ*, which, passing by the muscular tubercle of the thyroid cartilage, and by the intersection of the image of the aryepiglottic folds with that of the greater cornua of the hyoid bone, separates the anterior and posterior zones of the larynx. This is very important, as we know that lesions developing at the anterior portion of the larynx give fewer metastases than those occurring at the posterior portion.

In the diagrams reproduced in Figure 2, we see the different zones of the larynx and hypopharynx, giving an idea of the structures to which they correspond.

Lymph Node Metastases

When a malignant lesion has already produced metastases, its prognosis is much more serious, no matter which therapy we could use at the time. The clinical investigation of metastases, even in the cervical region, is very difficult, varying in thicker or thinner necks; it further depends on the practice of the person who is trying

TABLE 1.—*Nomenclature of the Hypopharynx and Larynx*

Organ	Regions	Zone	No.
Pharynx	Epipharynx (nasopharynx)		
	Mesopharynx (oropharynx)		
	Hypopharynx	Zone of the pyriform sinuses (R. & L.	10
		Zone of the posterior wall	11
		Retrocricoid zone	12
Larynx	Intermediate region	Zone of the free portion of the epiglottis	1
		Zone of the aryepiglottic folds (R. & L.	2
		Zone of the arytenoids (R. & L.)	3
	Epilarynx	Zone of the pad of the epiglottis	1a
		Zone of the ventricular folds (R. & L.)	4
		Zone of the ventricular cavities (R. & L.	5
	Mesolarynx	Anterior cordal zones (R. & L.) (ligamentous glottis)	6
		Posterior cordal zones (R. & L.) (cartilaginous glottis)	7
	Hypolarynx	Anterior zone of the hypolarynx	8
		Posterior zone of the hypolarynx	9

We have avoided naming the vestibule, glottis, and subglottis, as the regions we have just established do not correspond to the regions classically known by those names. Numbers refer to zones in Figure 2.

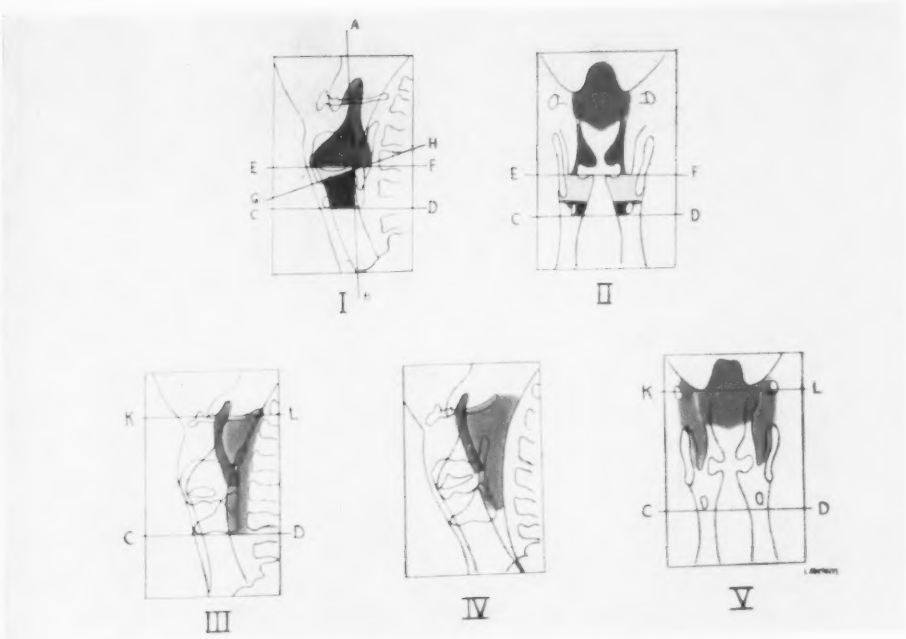

Figure 1

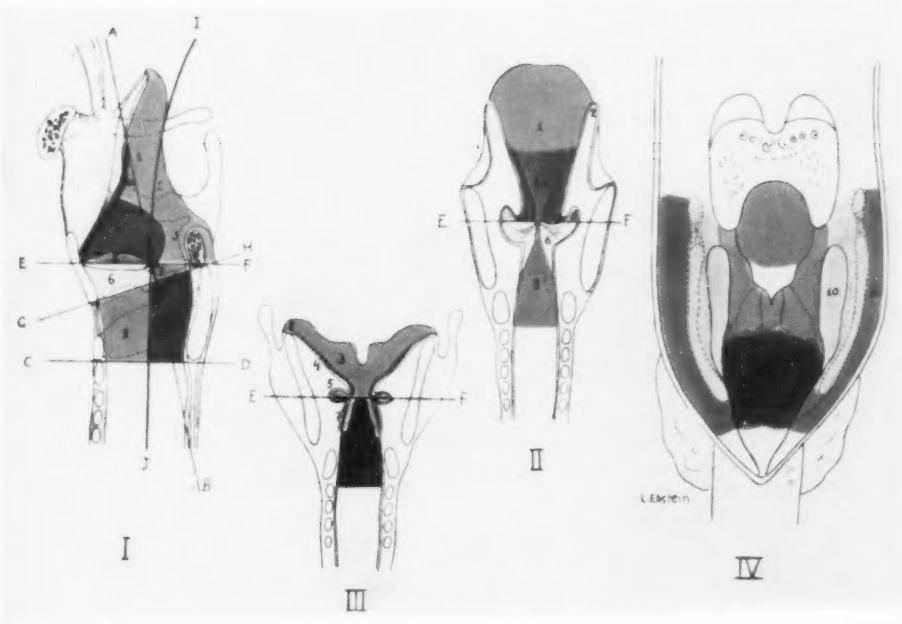

Figure 2

to determine, by palpation, the characteristics of the adenopathies.

However, though it is estimated that in about 50% of the cases where no lymph nodes can be found by palpation, they are already invaded, and that in 50% of the cases with palpable nodes there is no invasion which could be demonstrated histologically, we still think it is advantageous to include in the determination of the degree of malignancy the result of clinical investigation.

With Roxo Nobre, we have recently come to the conclusion that, in order to give a better uniformity between the classification of regional metastases and that of the primary lesion, it would be better to establish for regional metastases the following four grades:

Grade 0—no palpable nodes
Grade 1—small, soft node
Grade 2—larger or hardened node
Grade 3—node fixed to the underlying structures
Grade 4—node fixed to the skin
M 4—distant metastases

We believe this classification to be more accurate than the one proposed by the I. U. A. C., which includes under N_2 the hard or soft, small or large nodes, as long as they are not fixed.

The Union intends to avoid "personal impressions" and therefore does not agree with the separation of hard and soft nodes, but it allows personal impressions just the same when it separates the nodes into movable and fixed.

The question of the extension of the primary lesion to the skin, or the fixation of a node to the skin, brings about a more serious prognosis in the larynx and pharynx. This is the reason why—considering all aspects we have already presented—we propose the staging for cancers of the larynx shown in Table 2.

We must point out that lesions extending to the paralaryngeal spaces (right or left) and prelaryngeal space, are given Grade 3. We always consider as Grade 4 any distant metastasis.

TABLE 2.—*Clinical Staging of Malignant Tumors of the Larynx* *

Stage I	— Superficial lesion, limited to one zone (T_1) (without infiltration of the tissues, which retain their mobility); no palpable nodes (N_0) or small and soft nodes (N_1)
Stage II	— Infiltrating lesion, with fixation of the tissues, or lesion involving more than one zone of the same region or of different regions of the larynx (T_2) or larger or hardened node (N_2)
Stage III	— Lesion spreading to one whole portion (more than two regions) of the larynx, or lesion extending to a neighboring organ (T_3) or nodes fixed to the underlying structures
Stage IV	— Lesion fixating the larynx to neighboring organs, or lesion with wide extension into one or more neighboring organs (T_4), or node fixed to skin (N_4) or distant metastases (M_4)

* As proposed by Plinio De Mattos Barretto, in 1957.

The classification by staging is easily determined if we write the grades of regional and distant metastases, and those of primary lesions, always in the following order: M, N, T, and keep in mind that it is always the highest grade of T, M, or N that determines the stage.

So it is that in

Stage I—We would assemble the tumors 001 or 011
Stage II—002 - 012 - 021 - 022
Stage III—003 - 013 - 023 - 023 - 031 - 032 - 033
Stage IV—004 - 014 - 024 - 034 - 044 - 014 - 042-043 - 401 - 402 - 403 - 404 or any other combination with 4 in the 100's, which means distant metastases.

This staging, with its concept of regions and zones, might seem complicated at first glance, but those who will try it will soon see the advantages it presents for the uniformization of the nomenclature of tumors, and for the registration of the results of different therapies (follow-up of cases).

They will also see that by always writing in the same order the numbers representing the primary tumor and the distant metastases, the use of the symbols M, N, T becomes unnecessary.

So it is that, instead of writing, "Tumor of the epiglottis—Stage III—M_0 N_2 T_3," we can simply write, "Tumor of the epiglottis—Stage III—023."

It is convenient to stress that this staging should be established prior to any treatment, and should not be modified later. It is determined by general physical examination, or through examinations made with

instruments in current use for clinical diagnosis: in this particular case (larynx and pharynx), inspection and palpation of the neck, direct and indirect laryngoscopy, radiograms and tomograms.

But, for the observation and follow-up of the different cases, we must adopt still further elements of nomenclature, in order to write down the diagnosis and properly present the results.

When we have only the clinical diagnosis of tumor, we simply write the word tumor, followed by the anatomical location, the stage, and the different grades of the metastases and of the primary lesion, as in the example we have already given.

Whenever the histological examination of the primary lesion is made, the word tumor is replaced by the histogenetic classification, as, for example: epidermoid carcinoma of the epiglottis, Stage III, 023.

When the histological examination of the nodes is made, we advise adoption of the symbol H, followed by an ordinary fraction in which the numerator would be the number of cancer-invaded nodes, and the denominator the number of nodes examined.

We must write down the date of examination before the diagnosis and staging. If the patient is treated, we write the date in which treatment was started, the diagnosis and staging, the histological findings of nodes, and a synthetic description of the therapy applied.

To describe the patient's condition after a period of 12 months, we use one of the following symbols, recommended by the I. U. A. C.:

V_o—alive without cancer
V_c—alive with cancer
V_x—alive, with suspected cancer
D_o—died without apparent signs of cancer
D_c—died with cancer
D_x—died with suspected cancer
P—untraced after a year

With these elements we could write the diagnosis and follow-up of a case as follows:

9/1/54—Tumor of the epiglottis—Stage III (023)
12/1/54—S. C. carcinoma of the epiglottis—Stage III (023)
18/1/54—H $\frac{2}{50}$—Operation (total laryngectomy and bilateral neck dissection)
18/1/55—V_o (1)
18/1/56—V_o (2)
etc. . . .

The last figures in parentheses indicate the number of years of survival.

We intend to follow I. U. A. C.'s recommendations (see 1956 draft) for the de recovery rates, and graphic results.

Through this work we have answered to the best of our ability the I. U. A. C.'s call for cooperation, and in this work we have had the help and criticisms and suggestions of our colleagues of the Latin-American Committee and especially of Prof. Justo Alonso and of Dr. M. Roxo Nobre, who was the pioneer in Brazil in termination of survival rates, apparent the question of staging of cancer of the larynx.

R. Cons. Torres Homem 371.

The Surgical Correction of Aphagia Following Bulbar Poliomyelitis

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The purpose of this paper is to present a surgical technique for the relief of complete inability to swallow resulting from poliomyelitis. Inability to swallow is of common occurrence in bulbar poliomyelitis, but most cases recover. I have observed only five cases of permanent swallowing paralysis in 4975 poliomyelitis admissions at the Elizabeth Kenny Institute in Minneapolis during the past seven years. Accurate figures as to the actual incidence of aphagia are not available, but information received from various poliomyelitis centers indicates that there are approximately 150 such cases in the United States. In 1951 Kaplan [1] reported a single case of paralytic deglutition following poliomyelitis treated by section of the cricopharyngeus muscle. In the two cases reported in this paper a new surgical technique which proved successful in both cases will be presented.

Submitted for publication Nov. 19, 1957.

From the Elizabeth Kenny Institute, Dr. Bofenkamp consultant in Otolaryngology.

Before presenting the case reports and describing the surgical technique the anatomy, innervation, physiology, and pathology of the circopharyngeus muscle will be briefly considered.

The cricopharyngeus muscle was first described as far back as 1717 by Valsalva. In his original description, Valsalva referred to the cricopharyngeus muscle as a definite anatomical entity having very distinct features. Since his original description, however, succeeding anatomists have not universally recognized this anatomical concept and they have been content to describe the cricopharyngeus muscle as either the lower part of the inferior constrictor muscle of the pharynx or the upper part of the circular fibers of the esophagus. In a classical article by Batson [2] describing the anatomy of the cricopharyngeus muscle, which he observed after a special cadaveric preparation technique, he reconfirmed Valsalva's original concept of the cricopharyngeus muscle as being a definite anatomical entity. Bat-

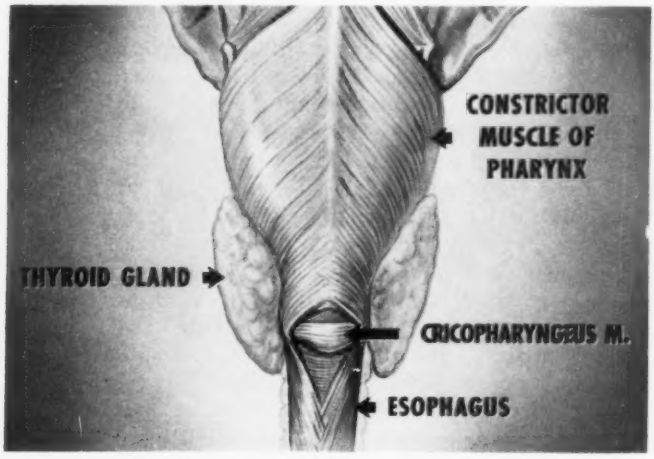

Fig. 1.—A posterior view of the hypopharynx and esophagus demonstrating the cricopharyngeus muscle.

Fig. 2.—A lateral view demonstrating the attachment of the cricopharyngeus muscle to the cricoid cartilage.

son describes the cricopharyngeus muscle as a circular band of horizontal fibers measuring approximately 20 mm. in height, which has its attachment to the cricoid cartilage laterally at the junction of the annular and signet portions of the cricoid cartilage. The muscle forms a sling enclosing the mucous membrane of the lowermost portion of the hypopharynx (Figs. 1 and 2).

The physiologists have demonstrated that the short horizontal fibers of the cricopharyngeus muscle have the ability to contract to one-half of their length, thus accounting for the tremendous sphincter action of the muscle. During esophagoscopy, this sphincter action is readily observed, and it was Jackson [3] who referred to this area as the cricopharyngeal pinchcock. This state of tonic contracture is the normal quiescent stage of the muscle. Negus [4] has demonstrated the object of this contraction, and its purpose is to prevent air from being inspired into the esophagus, where it would serve no useful purpose and only interfere with respiration by decreasing the effective tidal volume. Relaxation of the cricopharyngeus muscle occurs during deglutition when the bolus of food stimulates the sensory fibers of the vagus as the bolus passes the pharyngeal constrictors. As the cricopharyngeus muscle relaxes, the larynx is closed and respiration temporarily ceases. During this relaxation phase the bolus of food passes the cricopharyngeus area into the esophagus, whereupon the cricopharyngeus again constricts before respiration recommences. The tonicity of the muscle apparently varies among individuals. Many roentgenologists are of the opinion that the relaxed state of the cricopharyngeus is an expression of high intrapharyngeal pressure and that the contracted state is an expression of low pharyngeal pressure.[5]

The innervation of the cricopharyngeus muscle has been investigated mainly by the British. To date, it has been established that the principal nerve supply to the cricopharyngeus muscle arises from the glossopharyngeal nerve and the inferior laryngeal nerve, a branch of the vagus. The pharyngeal plexus supplying the muscle, in addition to the parasympathetic component, also has a rich supply of fibers arising from the superior cervical ganglion which forms the sympathetic component.[6]

Interesting experimental work has been done on the laboratory animal demonstrating the physiopathology of the cricopharyngeus muscle. It has been demonstrated in the cat that if a bilateral vagotomy is performed high up in the neck under the tympanic bulla there results not only a midline paralysis of the vocal cords but also a complete bilateral pharyngeal paralysis associated with a strong contracture of the cricopharyngeus muscle.[7] This spasm is claimed to be due

to a strong sympathetico-tonic contracture at the cricopharyngeus level. With interruption of the vagus nerve the parasympathetic component to the muscle is, of course, destroyed, and the sympathetic components arising from the superior cervical ganglion act independently and account for the marked sphincteric action. Clinically it can be assumed that in bulbar poliomyelitis the parasympathetic component of the pharyngeal plexus is eliminated by disease process, and the sympathetic component, seldom involved in poliomyelitis, remains intact and accounts for the spasm and resultant aphagia.

Clinically, I have observed several cases of aphagia following poliomyelitis, but most of them were temporary. Five cases had persistent aphagia for a period of almost two years and were not relieved until surgical removal of the cricopharyngeus muscle was performed. Two of these cases are to be presented in this article; the other three cases, because of coexisting otolaryngologic problems in addition to aphagia, are to be presented elsewhere.

Report of Cases

The first case was a senior student nurse who was stricken with bulbar poliomyelitis during the 1952 epidemic in northwestern Iowa. She was admitted to a hospital in Sioux City, Iowa, on July 26, 1952. Because of the inability to properly handle her oral-pharyngeal secretions, a tracheotomy was performed three days after admission. At that time, nourishment was maintained by intravenous feedings and continued to be maintained by that route during a two-week acute period of her disease. After the acute phase of the disease, she was fed by means of a gastric gavage tube introduced through the mouth.

Several months after the onset of her disease she was transferred to the Elizabeth Kenny Institute in Minneapolis. Upon admission there she was an extremely emaciated 22-year-old white woman, wearing a tracheotomy tube, and had to be in the artificial respirator continually. She drooled constantly from the corners of her mouth because of her inability to swallow. She had to be tube-fed four times daily.

Her general condition progressed very slowly because of frequent tracheobronchial complications resulting from aspirated secretions. Actual measurements of expectorated secretions frequently totaled over a liter per day. Thus it can be appreciated how miserable this patient was, not only being unable to swallow food but being entirely unable to handle her own salivary and nasopharyngeal secretions.

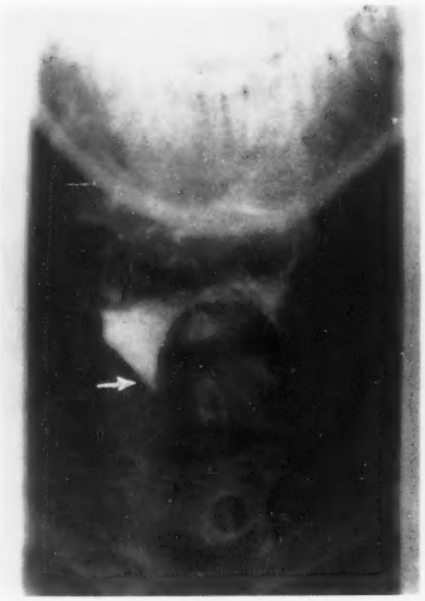

Fig. 3 (Case 1).—Before surgery. An anterior posterior view demonstrating the stagnation of the contrast medium in the valleculae.

A pharyngogram taken in May, 1955, after the patient's general condition had improved to allow for several hours' daily freedom from the respirator, demonstrated the contrast medium stagnant in the valleculae. It would not pass the cricopharyngeus area even one-half hour after ingestion (Fig. 3).

A prolonged period of psychotherapy and the employment of various antispasmodic drugs were to no avail. Frequent dilations of the cricopharyngeus area with the hydrostatic dilator were of no help, and her problem of aphagia persisted. On May 10, 1955, I employed the surgical technique of sectioning the cricopharyngeus muscle as described by Kaplan in 1951. In spite of this the aphagia persisted, and on Oct. 4, 1955, I removed the cricopharyngeus muscle in a manner to be described later. As soon as she recovered from anesthesia she discovered she could swallow her salivary secretions without difficulty. Within five days after surgery she began to take liquids by the oral route after being unable to swallow anything for 40 months. Gradually, she began to

Figure 4

Fig. 4 (Case 1).—After surgery. The contrast medium passes the cricopharyngeus level into the esophagus.

Figure 5

Fig. 5 (Case 2).—Lateral view before surgery. Even with the presence of a nasal gastric feeding tube the contrast medium does not pass the cricopharyngeus level.

swallow solids and at the present time can maintain her nutrition by the natural route (Fig. 4).

It is my impression that just sectioning the cricopharyngeus muscle may lead to reunion of muscle fibers as occurred in this case, and thus I advocate complete removal of the muscle.

The second case was a 14-year-old girl from Indiana, who was admitted to the Elizabeth Kenny Institute at Minneapolis on Feb. 4, 1957. She was severely stricken with bulbar poliomyelitis on Oct. 16, 1955, and was admitted to a hospital in Valparaiso, Ind. Upon initial hospitalization, she was placed in an artificial chest respirator. A tracheotomy was performed to facilitate tracheobronchial toilet when it became apparent she was unable to swallow and was aspirating secretions into her lower respiratory tract. She was removed from the respirator on Nov. 25, 1955; however, she still was unable to swallow even her own salivary and nasopharyngeal secretions. Her nutrition was maintained by frequent nasal-gastric tube feedings daily. After the acute phase she was discharged home and admitted to several hospitals for treatment of her swallowing difficulty.

In January, 1957, she reported with her parents to my office, where examination revealed a 14-year-old undernourished white girl wearing a tracheotomy tube, who was completely unable to swallow. Roentgenograms taken at the St. Barnabas Hospital demonstrated the inability of radiopaque substances to pass beyond the level of the pinchcock area of the esophagus. It was my impression that this patient's aphagia was due to cricopharyngeal spasm (Fig. 5).

She was admitted to the hospital, and on Feb. 4, 1957, the cricopharyngeus muscle was resected in the manner to be described. On the third postoperative day, when the feeding tube was removed, the patient began to swallow fluids. Two days later she was placed on a soft diet, and eventually she graduated to a regular diet. Ten days prior to her discharge on April 5, 1957, the tracheotomy tube was removed and she returned home breathing normally and eating a full diet—eight weeks after resection of the cricopharyngeus muscle (Fig. 6).

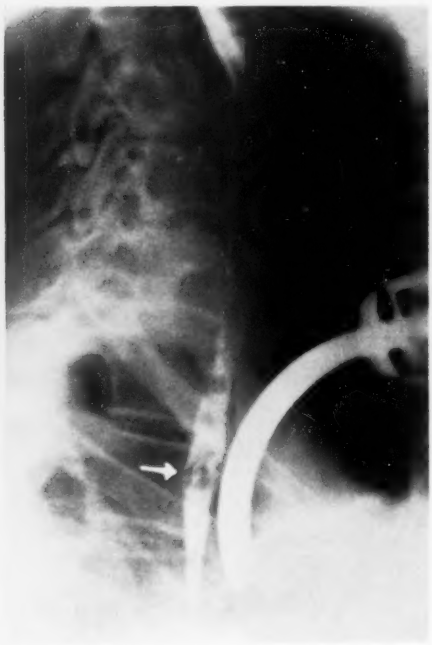

Fig. 6 (Case 2).—Lateral view after surgery. The contrast medium passes from the cricopharyngeus level into the esophagus.

Surgical Procedure

The operative procedure for excision of the cricopharyngeus muscle is performed under general anesthesia with intratracheal intubation. A horizontal incision is made through the skin, subcutaneous tissue, and platysma muscle midway between the thyroid and cricoid cartilages extending between the anterior borders of the sternocleidomastoid muscles (Fig. 7). The upper and lower flaps are undermined a short distance, bringing into exposure the strap muscles of the neck medially and the sternocleidomastoid muscle laterally (Fig. 8). It is necessary to expose just one side of the neck because, with retraction of the sternohyoid muscle medially and the sternocleidomastoid muscle laterally, the pharynx and larynx can readily be rotated so that their posterior aspect is clearly presented (Fig. 9). At this point the upper pole of the thyroid gland is mobilized and retracted downward in order to freely expose the cricoid cartilage with its cricopharyngeal attachments. The excision of the cricopharyngeus muscle is facilitated if an assistant introduces an esophagoscope at this stage to the level of the muscle. With the esophagoscope serving as a transilluminator the muscle can be bluntly pared away from the mucosa from one point of insertion to the opposite point of insertion on the cricoid cartilage (Figs. 10 and 11). When all fibers of the cricopharyngeus muscle have been removed, the area no longer has the pinchcock appearance through the esophagoscope but instead appears relaxed, and the esophagoscope passes freely (Fig. 12). With

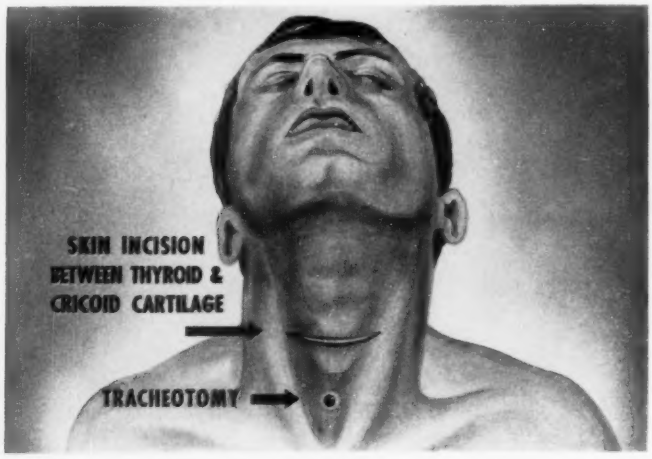

Fig. 7.—Site of the original incision.

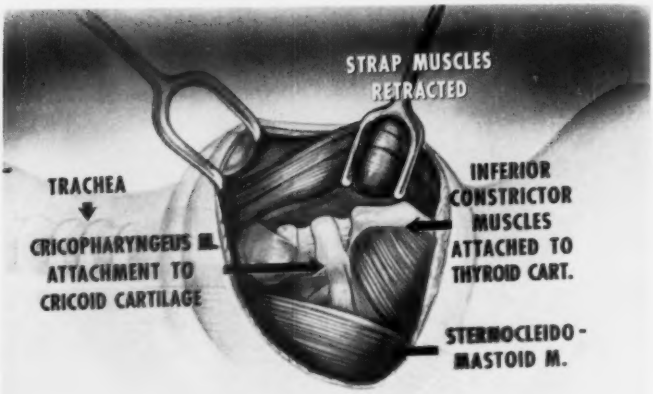

Fig. 8.—The upper and lower flaps of the original incision have been undermined and the strap muscles have been retracted to bring into view the cricopharyngeus muscle with its attachment to the cricoid cartilage.

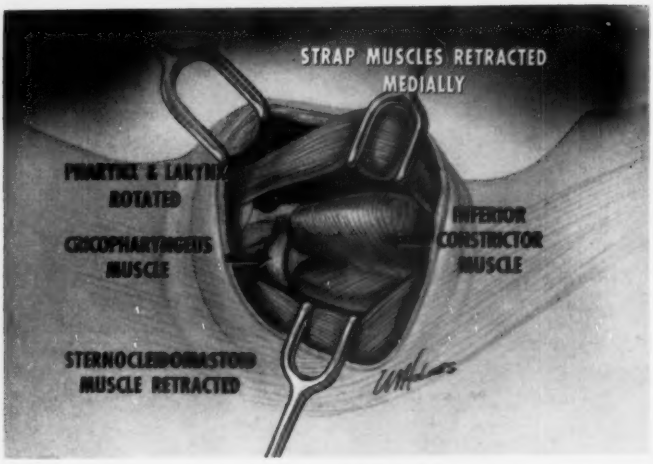

Fig. 9.—The larynx and pharynx are freely rotated medially to properly expose the entire cricopharyngeus muscle.

Fig. 10.—The cricopharyngeus muscle is bluntly pared away from the pharyngeal-esophageal mucosa.

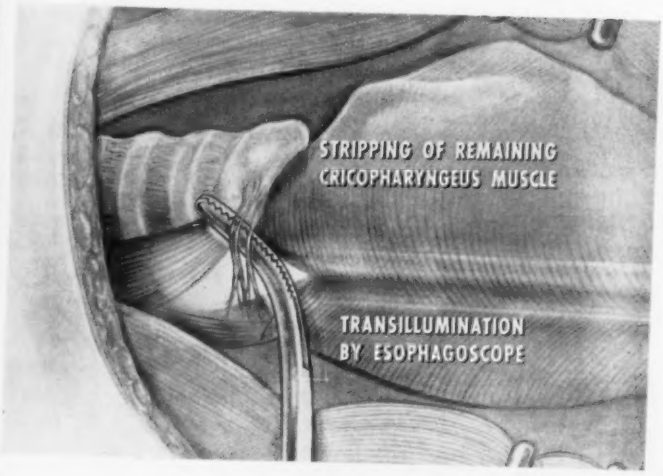

Fig. 11.—With use of an esophagoscope as a transilluminator all fibers of the cricopharyngeus muscle are assured of being removed.

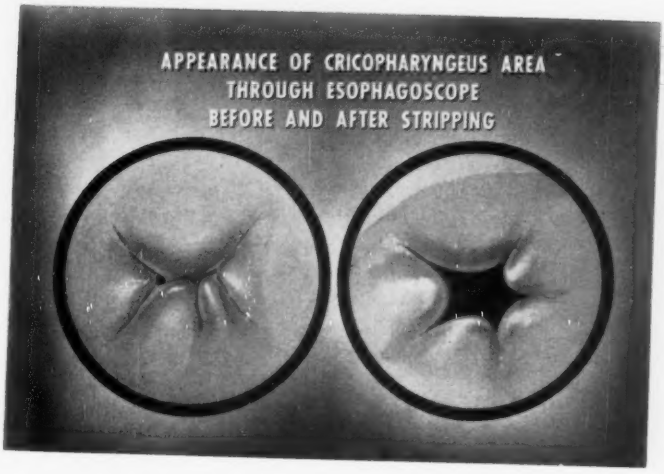

Fig. 12.—The appearance of the pinchcock area through the esophagoscope before and after removal of the cricopharyngeus muscle.

blunt excision of the muscle under transillumination there is little danger of perforating the mucosa and the wound can be closed without the use of drains. The preoperative feeding tube is removed and attempts to swallow are made on the first postoperative day.

Summary

A surgical procedure for correction of complete inability to swallow following bulbar poliomyelitis is described. The technique described consists of excision of the cricopharyngeus muscle. The anatomy, innervation, physiology, and pathology of the cricopharyngeus muscle are briefly considered, and two case reports are presented in which the described surgical procedure proved successful.

304 Doctors' Building.

REFERENCES

1. Kaplan, S.: Paralysis of Deglutition: A Post-Poliomyelitis Complication Treated by Section of the Cricopharyngeus Muscle, Ann. Surg. 133:572-573 (April) 1951.

2. Batson, O. V.: The Cricopharyngeus Muscle, Ann. Otol. Rhin. & Laryng. 64:47-54 (March) 1955.

3. Jackson, C.: Peroral Endoscopy and Laryngeal Surgery, Philadelphia, St. Louis, Laryngoscope Company, 1915.

4. Negus, V. E.: Affections of the Cricopharyngeal Fold, Laryngoscope, 48:847-858 (Dec.) 1938.

5. Templeton, F. E., and Kredel, R. A.: The Cricopharyngeal Sphincter—A Roentgenologic Study, Laryngoscope, 53:1-12 (Jan.) 1943.

6. Rogers, L.: The Treatment of Spasmodic Dysphagia by Sympathetic Denervation, Brit. J. Surg. 22:829-832 (April) 1935.

7. Sjöberg, A. A.: Experimental and Clinical Studies of Paresis of the Pharynx, Larynx and Oesophagus, Acta Oto-laryng. Supp. 38, pp. 1-84, 1939.

Experimental Fractures of the Stapes in Rabbits

Histopathological Studies

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Introduction

The mechanism of surgical mobilization of the ankylosed stapes for the relief of otosclerotic deafness has in the last few years become one of the most widely discussed problems in otology. Although very worth-while results have so far been achieved with various operative maneuvers, none of them is completely satisfactory, and therefore the attempts at improving the surgical techniques as well as theories concerning the mechanism continue to develop.

The opinions of different authors about the best approach to the problem vary greatly. As stated repeatedly before, it is the conviction of the group doing mobilization surgery at the Presbyterian Hospital in New York that mobilization through the otosclerotic focus itself is not likely to be lasting except in rare instances. The best chance to be successful permanently or at least over a prolonged period of time should in our opinion exist if through the intervention the part of the footplate is mobilized which had remained free from otosclerotic changes. It is furthermore desirable that the mobilization of the footplate in these cases is combined with a fracture in the upper portion of the crus of the stapes, usually the anterior crus, which had become immobilized by the ingrowth of otosclerotic bone into the footplate (Basek and Fowler).

Improvement in hearing has also been claimed in many instances by solely making a hole into the footplate without restoring its mobility.

The success of any of the operative interventions on the stapes is based on the fact that stapedial fractures have very little tendency to heal by osseous union. A review of all the reported cases (Altmann and Waltner, Brunner) shows that in all but one (Wolff) the fragments had failed to show bony union. In Wolff's case, that of a man of 52 years who had worked as a riveter for many years, on one side an old fracture of the posterior crus was noted without bony callus formation; on the other side, there was a healed fracture in the anterior portion of the footplate with bony callus formation.

Stapedial fractures show the same behavior as fractures through the enchondral layer of the labyrinthine capsule, and it is therefore not surprising that the stapes contains the same peculiar immature bone ("Strähnenknochen"—Meyer, Wustrow; "skein-like bone"—Fowler and Applebaum, Fowler) as the enchondral layer of the osseous labyrinthine capsule. According to Oesterle, the stapedial crura consist mainly of this skein-like bone with thin superficial layers of periosteal bone on the convex and often also the concave side. The footplate consists of two layers: an inner cartilaginous layer and an outer osseous layer, composed again of skein-like bone. This layer is usually thin, sometimes so thin that the footplate consists almost completely of cartilage. A larger amount of cartilage is in most instances present in the angle between the stapedial crura and the footplate; in the same area sometimes also true lamellar systems are found around blood vessels.

Submitted for publication Dec. 12, 1957.

Under a grant from the Central Bureau of Research of the American Otological Society.

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Occasionally a thin layer of periosteal bone is deposited on the outer (tympanic) surface of the skein-like bone of the footplate (Meyer).

Under the given circumstances it was to be hoped that histologic studies on experimental fractures of the footplate in animals might be useful in developing new and more effective operative methods of stapes mobilization in man and also in the recognition and prevention of the causes of reankylosis of a mobilized stapes.

Thorough comparative histologic studies of the finer structure of the stapes in laboratory animals are not available, but investigations of the bony labyrinthine capsule have shown that the capsule of monkeys (Haag) and dogs (Wilhelm) is practically identical in structure with that of man and that the capsule of rabbits and guinea pigs (Hafner) shows enough similarities to make it suitable for many types of experimental studies. For reasons of economy, it was decided to carry out our studies on rabbits.

In rabbits the stapedial crura as well as the footplate consist solely of skein-like bone, except for a thin and narrow cartilaginous layer on the inner surface of the footplate in the vicinity of the rim. As will be shown later, periosteal bone may be deposited on the outer surface of the footplate and on both surfaces of the crura in the course of middle ear infections, which are quite frequent in rabbits. It is questionable, however, if the deposits also occur without such inflammatory stimuli.

Experiments

Experiments were carried out on 22 rabbits; 17 of them were white adult animals with an average weight of 1.5 kg., and 5 young animals, about 6 weeks old, with an average weight of 1.2 kg. All possible care was taken to use animals with noninfected middle ears, but in two of them, there was evidence of middle-ear infection at the time of operation. Veterinary pentobarbital (Nembutal Sodium [Abbott]) was used for anesthesia, 1 cc. (30 mg.) per kilogram body weight, injected intraperitoneally. If necessary, this dosage was supplemented by intravenous injection of 10-20 mg. into the auricular vein. One ear, as a rule the left, was operated upon, and the other ear served as control. Clean but not strictly sterile technique was used.

The hair at the base of the auricle was shaved off, the skin cleaned with 70% alcohol, and about 1 cc. of a 1% procaine solution with epinephrine injected into and around the operative field to help hemostasis. A horizontal incision, about 1.5 cm. in length, was made just above the palpable bulla, and the lateral wall of the auditory canal cut through. The laterosuperior part of the bony canal wall was bitten off with a small rongeur and the drum exposed. The middle ear was entered through the posterosuperior quadrant of the drum and the ossicular chain brought into view. In some cases both the malleus and incus were removed, in others the incudostapedial joint opened and the long process of the incus dislocated. In the majority of cases, however, the anterior crus of the stapes was broken through and the anterior third of the footplate fractured with a needle without disturbance to the ossicular chain. Since the oval window niche is very deep in rabbits, it is difficult to visualize the footplate. The manipulations on the footplate were therefore never ended before one had the impression that perilymphatic fluid had escaped into the niche. All blood was removed from the middle ear as thoroughly as possible, and a combination of neomycin, bacitracin, and polymixin powder was insufflated into the middle-ear cavity. The incision in the auditory canal was then closed with interrupted chromic absorbable sutures. No antibiotics were given in this series; they were, however, used in a second series of experiments to be published at a later date.

Six animals were found dead at various times after operation. The other 16 were killed at different times, varying from three days to eight months after surgery. After removal of the brain, the base of the skull was fixed in a 10% formalin solution. The two temporal bones, together with the part of the base between them, were after fixation decalcified, embedded in celloidin, sectioned in serial sections, 20μ thick, and stained with hematoxylin and eosin.

Report of Cases

Rabbit 1 (685).—Adult animal. Found dead 18 hours postoperatively.

Right ear without pathology.

Left ear: Large perforation in the posterosuperior portion of the drum. Fresh acute fibrinopurulent inflammation of middle ear and bulla. The anterior crus of the stapes is broken in its lower third and the anterior half of the footplate in three places. The continuity of the endosteal lining is interrupted. In this way two fragments

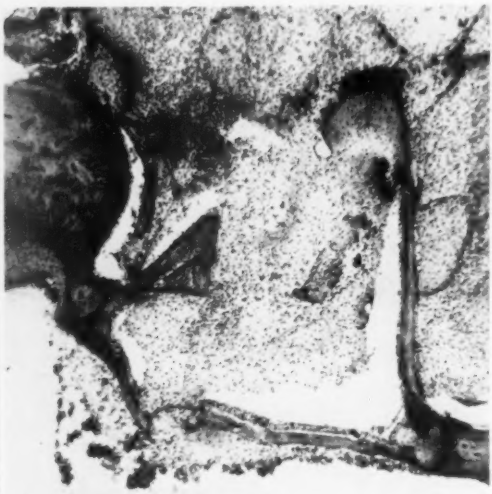

Fig. 1 (Rabbit 1).—Fractures of the anterior stapedial crus and of the footplate. Fibrinopurulent exudate extending through the gaps in the footplate into the vestibule.

are formed (Fig. 1).* The anterior fragment is slightly pushed inward toward the lumen of the vestibule. Fibrinopurulent exudate extends through the gaps in the footplate from the middle ear into the vestibule. The remaining parts of the vestibule show a diffuse serous, and already in some places fibrinopurulent inflammmation. The infection had, in addition, already spread to the meninges and caused a beginning purulent meningitis.

RABBIT 2 (670).—Adult animal. Found dying three days postoperatively; killed three days postoperatively.

Right ear: Middle ear and bulla show the signs of a very mild purulent infection. The inner ear shows a diffuse, mainly serous, but in some places already purulent infection, evidently of meningogenic origin.

Left ear: The external auditory meatus contains purulent exudate. Large perforation in the posterosuperior quadrant of the drum. There is an acute purulent infection of the middle ear and bulla. The capsule of the incudostapedial joint is torn, and the head of the stapes pushed forward. The whole stapes is furthermore slightly pushed inward toward the vestibule. The anterior crus is fractured near its attachment to the rim of the stapedial footplate; in addition, a crack is seen above this point. The posterior crus shows also several cracks near its junction with the footplate. The annular ligament is torn and the footplate broken in several places. Some fragments, such as the posterior portion of the rim, are pushed somewhat deeper into the vestibule. The purulent infection of the middle ear extends through the broken footplate into the vestibule and the other parts of the labyrinth and from there has spread throughout the entire labyrinth and to the meninges.

RABBIT 3 (679).—Adult animal. Found dead six days after the operation.

Left ear without pathology.

Right ear: The external auditory meatus is filled with coagulated blood; the drum shows a large posterosuperior perforation. The middle ear and bulla contain blood and seropurulent exudate; the mucosal lining shows mild acute inflammatory changes. The lower half of the anterior stapedial crus is missing; the upper portion shows a crack near its junction with the capitulum. The anterior portion of the footplate near the rim is traversed by a fracture line, and a tiny fragment is slightly displaced inward. The continuity of the endosteal lining is interrupted in this place, and the inner surface of the break is covered with a small plug consisting mainly of fibrin and red blood cells. The labyrinth shows only marked postmortem changes. The cause of death remains undetermined. It is evidently not related to the changes in the ear.

RABBIT 4 (653).—Adult animal. Found dead seven days postoperatively.

Right ear without pathology.

Left ear: The external auditory meatus is filled with coagulated blood. The drum shows a large posterosuperior marginal defect. Malleus and incus are separated from the stapes and protrude through the perforation into the external meatus.

* The photomicrographs were taken in the Photographic Laboratory of the ENT Department by V. Epanchin, M.D.

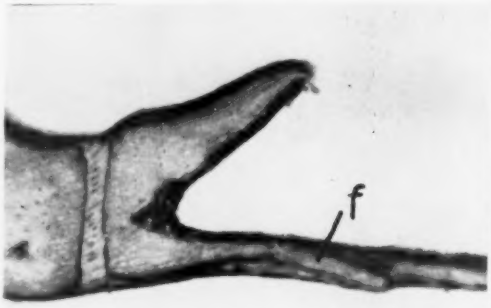

Fig. 2 (Rabbit 5).—Small piece of the footplate (*f*) fractured and slightly pushed inward; endosteal lining intact.

The short process of the malleus is broken off from the handle and still in contact with the drum. The latter, at the margin of the perforation, is laid in several small folds. The middle-ear cavity and its recessus as well as the bulla contain a dark-red-staining mass. In the oval window niche the stapes is surrounded by polymorphonuclear leukocytes. The stapes itself is intact, but its posterior part is pushed into the lumen of the vestibule. The annular ligament is torn; the endosteal lining of the footplate and of the adjacent part of the vestibule shows a circumscribed proliferation and in this way has closed the gap between the posterior circumference of the window frame and the edge of the footplate. The anterior part of the footplate has remained in place, although the annular ligament is also torn and two small pieces of bone are broken away from the window frame. One of them protrudes slightly into the vestibular lumen, and here again the endosteal layer shows a circumscribed slight proliferation. The torn ligament is replaced by granulation tissue which contains a small cystic space filled with polymorphonuclear leukocytes.

The inner ear shows a mild serous labyrinthitis, more marked in the vestibular portion than in the cochlea. There is no evidence of meningitis. Again, the cause of death remains undetermined.

Rabbit 5 (680).—Young animal. Killed 14 days postoperatively.

Left ear without pathology.

Right ear: The external meatus contains coagula; the drum shows a large posterosuperior perforation, and there are some blood coagula in middle ear and bulla. The mucosal lining is thin. Incus and malleus are missing, together with the stapedial capitulum and the anterior crus, with exception of its lowermost part. The stapedial footplate is traversed near its anterior rim by two fracture lines, and a small piece of bone is slightly pushed inward (Fig. 2). The endosteal lining, however, is intact. The fibers of the anterior portion of the annular ligament are stretched but not torn.

The inner ear is without pathology.

Comments on Cases 1-5

As is to be expected, the first four cases show an infection of middle ear and bulla of varying intensity. In three of them (Cases 1, 3, 4), the infection was confined to the side operated on and probably was caused by the operation. In one of them (Case 2) it was bilateral and could, therefore, have already existed at the time of operation. In Case 5, examined two weeks after operation, either no infection had developed or it had already subsided. In three cases (1, 2, 4) the middle-ear infection had spread to the labyrinth, causing a serofibrinous (Case 1), purulent (Case 2), and serous inflammation (Case 4). In the first two cases the infection had also spread to the meninges, and in the second case, three days after the operation, had even already caused a meningogenic labyrinthitis on the other side. These observations show how virulent the postoperative infection can be and clearly point to the necessity of the postoperative use of adequate doses of broad-spectrum antibiotics. The absence of labyrinth infection in Case 3, six days after

operation, was probably due to the formation of a small thrombus at the vestibular surface of the break in the endosteal lining of the footplate. It can be regarded as an attempt at blocking the spread of the infection and at restoring the interrupted continuity of the endosteum. The circumscribed endosteal proliferation in Case 4 seems to serve the same purpose, but the infection had evidently spread to the labyrinth before the gap between window frame and footplate had been closed.

The absence of the signs of labyrinthine infection in Case 5 does not necessarily mean that at least a mild irritation had not been present immediately after the operation. Similarly the intact endosteal lining could be due either to the absence or the complete healing of a tear.

RABBIT 6 (636).—Adult animal. Killed 28 days postoperatively.

Right ear without pathology.

Left ear: The external canal contains a big plug of desquamated horny masses and necrotic debris which extends through a large perforation in the drum into the middle ear. Small amounts of coagulated blood are found in the oval-window niche and other recessus. The mucosal lining of the middle ear and bulla is thin and without inflammatory changes. The anterior crus of the stapes is almost completely missing. Two small bony spicules are still seen connected with the rim of the footplate and a few others embedded in coagula. A fracture line goes through the anterior portion of the footplate near the rim. The part of the footplate adjacent to the fracture line is slightly pushed toward the vestibule. The endosteal lining of the footplate is, however, intact and thin. There is nowhere evidence of callus formation. The inner ear is free from pathology.

Comment on Case 6

The complete absence of reactive changes around the fracture line through the footplate and the intactness of the endosteal lining deserve mentioning.

RABBIT 7 (682).—Adult animal. Killed 28 days postoperatively.

Right ear without pathology.

Left ear: The external auditory meatus is filled with an epidermis plug; the drum membrane shows a posterosuperior perforation. The lining of the middle ear and bulla is thin. The lumen contains a small amount of a homogeneous, dark-red-staining substance.

The lower half of the anterior crus of the stapes is missing, and the anterior half of the footplate is traversed by two fracture lines; one is located near the center, the other one near the anterior circumference. The annular ligament is intact. The broken portion of the footplate shows a slight outward curve. Small gaps are seen between the fractured and the intact portions of the footplate. The gap near the center is larger and contains some coagulated blood. The endosteal lining of the vestibular surface of the footplate is thickened and torn over the gaps; some of the blood coagula extend for a short distance into the vestibular

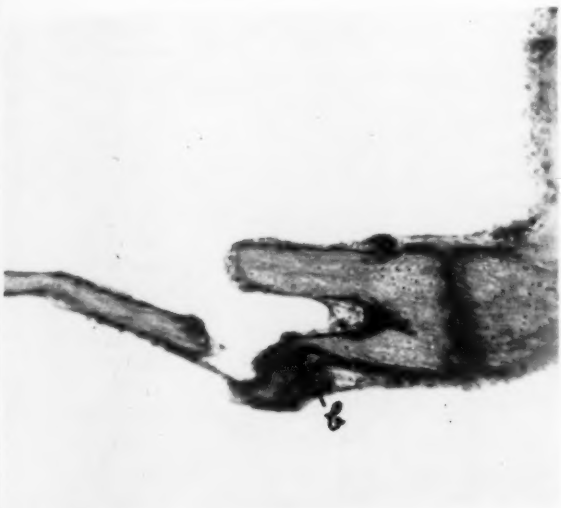

Fig. 3 (Rabbit 7).—Small piece of the footplate pushed inward and lateral. Newly formed endosteal bone (*b*) connecting the fragment with the peripheral portion of the footplate.

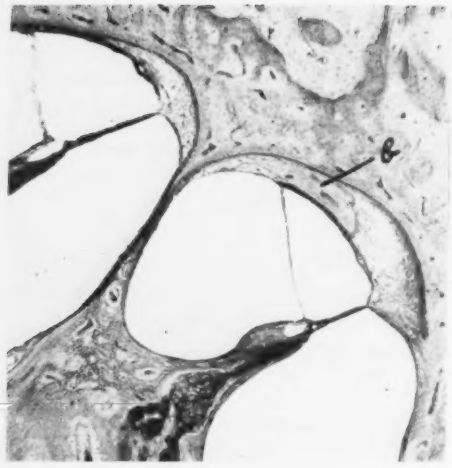

Fig. 4 (Rabbit 7).—Bone formation (*b*) in the upper part of the spiral ligament of the lowermost portion of the basal cochlear turn.

lumen. The endosteal lining over the peripheral fracture line is intact. In this region a tiny splinter of bone has been pushed laterally, underneath the endosteum, over the vestibular surface of the peripheral portion of the footplate. It is connected with the latter by a small amount of newly formed endosteal bone (Fig. 3).

The inner ear shows marked postmortem changes which prevent the recognition of possible intravital pathology. Extensive bone formation is noted in the upper part of the spiral ligament of the lower portion of the basal cochlear turn (Fig. 4). Several small foci of newly formed bone, deposited at the inner surface of the bony labyrinth capsule, are also seen in the spiral ligament of the upper portion of the basal turn. No such bone formation is present on the right side.

Comment on Case 7

The complete absence of reactive changes around the break in the endosteal lining of the footplate and within the vestibule make it very doubtful that the break was present during life. It is most probably an artefact.

The new formation of bone around the displaced splinter of bone at the vestibular surface deserves particular attention; it had evidently originated in the endosteal lining.

The bone formation in the upper part of the spiral ligament of the basal cochlear turn had most probably started in the course of healing of a postoperative serous labyrinthitis.

RABBIT 8 (630).—Adult animal. Evidence of middle-ear infection at the time of operation. Killed six weeks postoperatively.

Right ear: without pathology.

Left ear: The external auditory meatus contains an epidermis plug. The drum is intact but markedly retracted and partially adherent to the medial tympanic wall. Incus and malleus are absent with exception of the short process of the latter which is still in connection with the drum. Middle ear and bulla are lined with thin mucosa which is free from acute inflammatory changes. The stapes is in toto pushed slightly inward into the lumen of the vestibule; it is in addition tilted backward and has come into contact with the facial nerve (Fig. 5). The crura are intact. The anterior third of the footplate, including the rim, is broken away from the rest of the footplate, turned 180 degrees, and pushed still deeper into the vestibule. Some apposition of newly formed bone is seen on the surface of the two portions of the footplate. The whole labyrinth shows the signs of a healing purulent infection with the severest changes in the scala vestibuli of the cochlea. All the cavities are filled either with purulent exudate in the state of organization or with connective tissue which in various places, such as the vestibule, shows extensive new formation of bone, starting at the bony walls of the cavities.

Comment on Case 8

The large break in the continuity of the footplate had evidently been responsible for the spread to the labyrinth of the middle-ear infection which had been present at the time of operation but which in the meantime had subsided. It might also have been responsible for the severity of the labyrinthine infection.

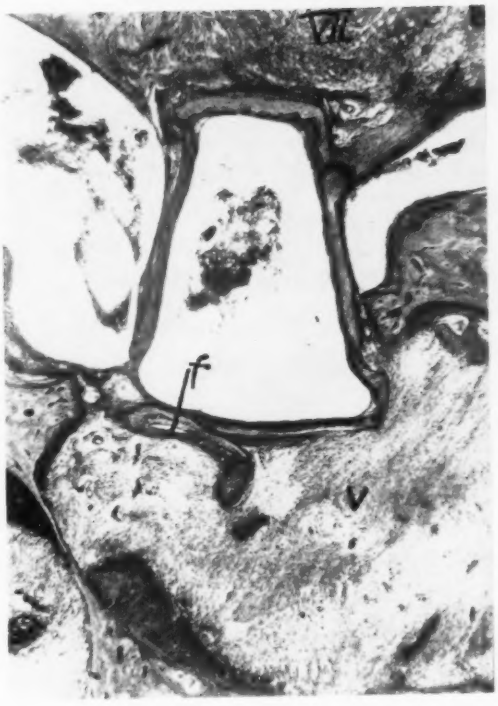

Fig. 5 (Rabbit 8).—Stapes pushed slightly inward, into the lumen of the vestibule (*v*); capitulum in contact with the facial nerve (VII). Anterior third of the footplate (*f*) fractured, rotated, and pushed into the vestibule.

Rabbit 9 (604).—Adult animal. Killed two months postoperatively.

Right ear without pathology.

Left ear: The external meatus is filled with masses of desquamated keratin and blood coagula which extend through a large perforation in the drum into the middle ear. Coagula are also seen in the oval-window niche and other recessus of the middle-ear cavity. The mucosal lining of middle ear and bulla is free from inflammatory changes. The lenticular process of the incus is broken away from the rest of the bone and still connected with the head of the stapes. The lower end of the long process of the incus lies in front of the anterior surface of the incudostapedial joint and has become connected by bony bridges with

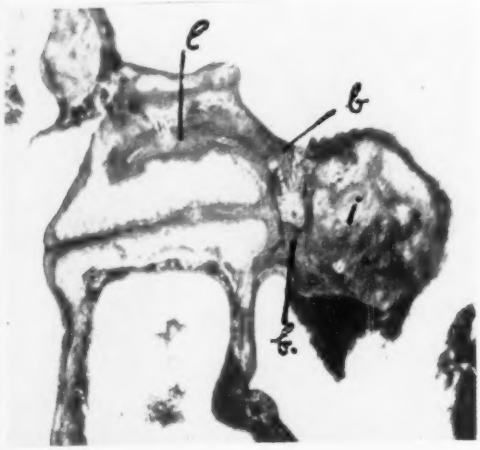

Fig. 6 (Rabbit 9).—Lenticular process of incus (*i*) still connected with capitulum of stapes. Lower end of incus (*i*) connected by bony bridges (*b*) with lenticular process as well as with anterior crus of stapes.

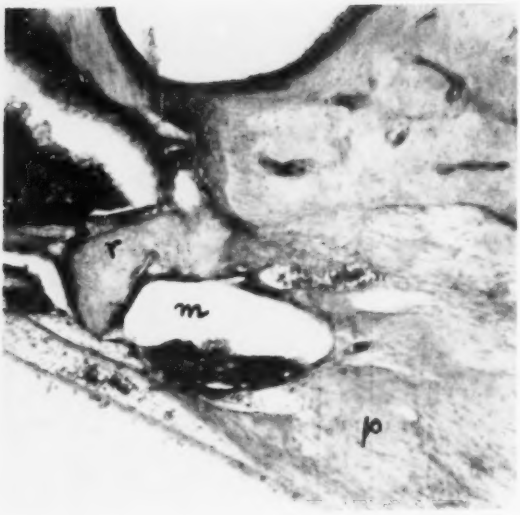

Fig. 7 (Rabbit 9).—Small portion of the stapedial rim (*r*) pushed into the vestibule. Perilymphatic tissue (*p*) proliferated; a small recessus of the middle-ear lumen (*m*) extends around the fragment.

the uppermost portion of the anterior crus of the stapes and the lenticular process of the incus (Fig. 6). The greater portion of the anterior crus is missing. Its lower end is fractured at the place where it is attached to the footplate but is still in connection with it. The posterior crus is cracked at the border between the middle and the upper third; there are no reactive changes around the fractures. The head of the stapes, together with the incudostapedial joint, is slightly dislocated backward toward the facial canal. The lenticular process of the incus has thereby become connected with the latter by strands of connective tissue.

The anterior portion of the footplate near the rim and the rim itself are cracked in several places. A small portion of the rim has been broken away from the rest of the footplate and pushed into the vestibule (Fig. 7). It is surrounded by proliferated perilymphatic tissue in which a vivid new formation of bone is noticed. A small recessus of the middle ear lumen extends around the piece toward the perilymphatic tissue; it contains some coagulated blood.

The labyrinth shows signs of a healed serous labyrinthitis of a mild degree with the usual dislocation of the tectorial membrane in the cochlear duct. In the lowermost portion of the basal cochlear turn new formation of bone is noted in the part of the spiral ligament just above the stria vascularis. The bone formation seems to start in the subepithelial area and to extend from there towards the deeper parts.

Rabbit 10 (635).—Young animal. Killed two months postoperatively.

Fig. 8 (Rabbit 10).—Multiple fractures of the stapedial footplate. Endosteum (*e*) thickened.

Right ear without pathology.

Left ear: The external canal contains a plug of desquamated keratinized lamellae and necrotic debris. The drum membrane is intact. The middle ear mucosa is slightly thickened.

The middle third of the anterior crus of the stapes is missing. The anterior half of the footplate is broken into several pieces and some of them very slightly pushed inward. The annular ligament is intact. The endosteal lining of the vestibular surface of the footplate is slightly thickened but without break in its continuity (Fig. 8). In the center of the footplate the bone is completely missing in a rather large area. One of the fragments is covered on the inner surface by a thin layer of endosteal bone and connected by it with the adjacent fragment; other fragments show no callus formation.

The cochlea shows residua of a healed mild serous labyrinthitis. Throughout the entire basal cochlear turn the connective tissue of the upper third of the spiral ligament is replaced by endosteal bone and in some places the ossification is still progressing. The ossification extends throughout the entire width of the ligament up to the base of the stria vascularis. The latter is, however, normal. In the lower part of the second turn, the extent of the bone formation gradually decreases. No similar changes are seen on the other side. The lowermost portion of the scala tympani, in the vicinity of the inner opening of the cochlear aqueduct, contains a small amount of coagulated blood. The blood has not penetrated through the inner limiting membrane into the reticular tissue of the aqueduct itself. In the vestibular portion the residua of the serous labyrinthitis are much less marked.

RABBIT 11 (645).—Adult animal. Killed two months postoperatively.

Right ear without pathology.

Left ear: The external auditory meatus contains an epidermis plug; the drum shows a posterosuperior perforation.

The mucosal lining of middle ear and bulla is thin. Some niches contain a small amount of purulent exudate. A few strands of organized tissue, almost entirely composed of phagocytes with foamy protoplasm, extend between the inner surface of the drum and the medial wall of the tympanic cavity. The capsule of the incudostapedial joint is torn and the head of the stapes separated from the long process of the incus. Both crura of the stapes are broken; the lower two-thirds of the anterior crus are missing with exception of a small splinter of bone which is still connected with the footplate by connective tissue. The posterior crus shows a fracture line approximately at the border between lower and middle third without dislocation of the fragments. There is no evidence of callus formation. Several small splinters of bone, evidently remnants of the shattered anterior crus, are seen in the oval-window niche, embedded in exudate. The anterior part of the footplate is broken in two places, at the periphery, near the rim, and further inward.

The broken portion is slightly pushed inward toward the lumen of the vestibule. It is connected with the thin central portion of the footplate by a thin bridge of newly formed bone. Peripherally, the fragment is separated from the remainder of the footplate by a relatively wide gap. The endosteal lining of the vestibular surface of the footplate is slightly thickened. Instead of bridging the gap, it lines a small recessus of the middle-ear lumen which extends through the gap for a short distance toward the vestibule. The perilymphatic tissue in this area is markedly proliferated and contains in the vicinity of the anterior part of the stapediovestibular joint a few trabeculae of newly formed bone. Otherwise, the labyrinth shows evidence of a healed serous labyrinthitis of a mild degree.

Comments on Cases 9-11

The absence of bony callus formation around the fracture of the posterior stapedial crus in Cases 9 and 11 is noteworthy in view of the extensive callus formation around the lower end of the long process of the incus in Case 9.

Multiple fractures of the footplate were present in Cases 9 and 10. In Case 10, where the fragments had more or less stayed in place, the continuity of the endosteal lining had been restored without any callus formation or any reactive changes in the vestibule. In Case 9, where a fragment had been pushed more deeply into the vestibule, a circumscribed proliferation of the perilymphatic tissue of the vestibule with extensive new formation of bone within the proliferated tissue had taken place. In Case 11, where a small portion of the footplate had been pushed into the vestibule, again a circumscribed proliferation of the perilymphatic tissue with new formation of bone is noted. The central part of the broken fragment, which had remained in closer contact with the rest of the footplate, has become reunited with the latter by bony callus. In both cases a wider break in the continuity of the endosteum

Fig. 9 (Rabbit 12).—Part of the stapedial rim (*r*) pushed into the vestibule, surrounded by proliferated perilymphatic tissue, and connected with the vestibular wall by newly formed bone (*b*).

had evidently occurred in one area, and the gap had not simply been closed, but a short evagination of the middle ear lumen through the gap into the vestibule had developed, an occurrence which is not uncommonly seen in such cases.

In all three cases the operation had been followed by a serous labyrinthitis which had completely healed. The new formation of bone in the upper portion of the spiral ligament in the basal cochlear turn in two of them deserves attention.

Rabbit 12 (627).—Adult animal. Killed three months and nine days postoperatively.

Right ear without pathology.

Left ear: The external auditory meatus contains an epidermis plug and some purulent material. The drum shows a large anterosuperior perforation, the middle ear and bulla an acute purulent infection. The long process of the incus is separated from the head of the stapes and embedded in adhesions. The anterior crus of the stapes is fractured in several places. Two fragments in the lower part of the crus, not far from its junction with the footplate, override each other, but there is no evidence of callus formation. The anterior portion of the footplate, near its rim, together with the adjacent parts of the anterior crus are shattered into several small fragments which are embedded into connective tissue. Connective tissue has also replaced the annular ligament. A somewhat larger piece of bone, representing a portion of the rim of the footplate, has been pushed into the lumen of the vestibule (Fig. 9). It is embedded into a layer of proliferated perilymphatic tissue and connected with the bony wall of the vestibule by a small amount of blue-staining bone. There is evidence that bone formation is still progressing within the perilymphatic tissue. The proliferated area extends over the inner surface of the footplate and the adjacent parts of the vestibular wall. Toward the lumen a thin limiting membrane has been formed.

The inner ear shows marked autolytic changes but no other pathology.

Rabbit 13 (640).—Adult animal. Killed three months and 10 days postoperatively.

Right ear: The middle ear contains some pink-staining, finely granular fluid. Otherwise, there is no pathology.

Left ear: The external auditory meatus is free from contents; the drum membrane shows a large posterosuperior perforation. The middle ear and bulla are lined with normal mucosa.

The anterior crus of the stapes is intact. The posterior crus is broken near its junction with the rim of the footplate, and a small piece of bone has been pushed slightly forward. The continuity of the periosteum, however, is preserved, and there is no evidence of callus formation. The footplate is broken in several places (Fig. 10). Some of the fragments are pushed slightly into the vestibule, and a short recessus of the middle ear lumen is seen extending between two fragments of the footplate toward the vestibule. The perilymphatic tissue is proliferated, particularly around the anterior half of the footplate, and there is extensive and still progressive bone formation around the bone chips within the perilymphatic tissue. The endosteal lining over the posterior portion of the

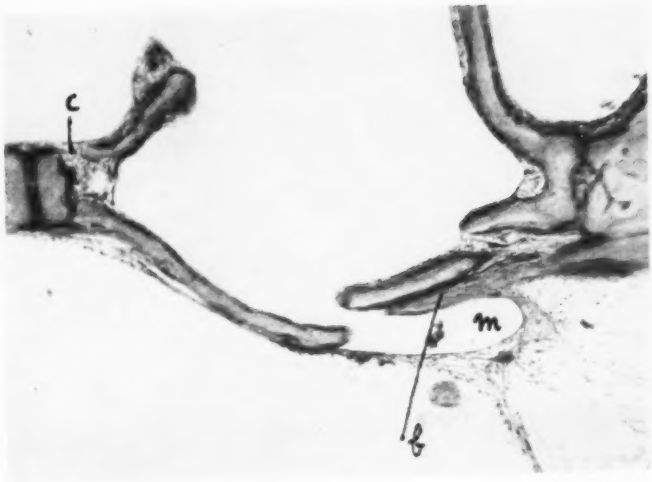

Fig. 10 (Rabbit 13).—Fracture of the posterior crus (*c*) and multiple fractures of the footplate. Bone formation (*b*) in the proliferated perilymphatic tissue. Recessus of middle ear (*m*) extending toward vestibule.

footplate is slightly thickened, and a thin layer of bone has been deposited over the inner surface of the annular ligament and of a broken piece of the footplate which protrudes into the vestibule. Here the newly deposited layer of bone forms a thin bridge between this fragment and the adjacent part of the footplate.

The membranous labyrinth presents the signs of a healed serous labyrinthitis of moderately severe degree; in the cochlear duct there is in some places evidence of a seropurulent infection.

Comment on Cases 12 and 13

The absence of callus formation around the fractures of the stapedial crura deserves mention. In both cases multiple fractures of the footplate with displacement of some of the fragments into the vestibule were present. This has again been followed by a mostly serous labyrinthitis in one of them (Case 13) but not in the other one, and a circumscribed proliferation of the perilymphatic tissue with new formation of bone around the displaced bone chips in both of them. In Case 13 again an evagination of the middle-ear lumen toward the vestibule between two fragments had taken place. The postoperative middle-ear infection which evidently had been present in this case had cleared up completely.

RABBIT 14 (647).—Adult animal. Killed four months postoperatively.

Right ear without pathology.

Left ear: The external auditory meatus is filled with a big plug, consisting mainly of desquamated keratinized epithelium and necrotic debris. The drum is considerably retracted and adherent to the medial wall of the tympanic cavity and to the head of the stapes. The long crus of the incus is missing, the stapes rotated backward, and the annular ligament completely torn. The capitulum of the stapes lies in a dehiscence of the bony facial canal; the posterior portion of the footplate protrudes toward the lumen of the vestibule, the anterior portion toward the lumen of the middle ear. A recessus of the middle-ear lumen extends through the gap between the anterior circumference of the stapedial footplate and the rim of the oval window along the inner surface of the footplate almost to the posterior end of the latter. There is no evidence of a fracture either of the crura or of the footplate of the stapes. The perilymphatic tissue of the vestibule is markedly proliferated and the utricule and saccule dilated. Within the proliferated perilymphatic tissue adjacent to and in front of the footplate, still progressive new formation of bone is noted, extending from the medial wall of the vestibule toward the footplate. The whole labyrinth shows the signs of a healed moderately severe serous labyrinthitis.

RABBIT 15 (681).—Adult animal. Killed four months and five days postoperatively.

Right ear: There are marked acute purulent inflammatory changes of the mucosa of middle ear and bulla with extensive necrosis of the drum membrane. Small deposits of periosteal bone are noted on both surfaces of the anterior as well as the posterior stapedial crus.

The inner ear is normal.

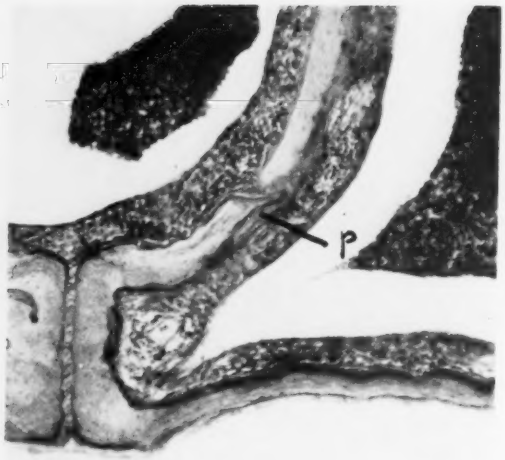

Fig. 11 (Rabbit 15).—Fracture of posterior stapedial crus with periosteal callus (*p*).

Left ear: The external auditory meatus is filled with a large epidermis plug. The drum is intact. Marked purulent inflammation of middle ear and bulla. The oval window niche contains strands of organized tissue. The anterior crus of the stapes is fractured near its lower end and slightly pushed inward toward the footplate. The lower third of the posterior stapedial crus is traversed by a fracture line. At the inner end of the line the broken parts are united by a thin layer of newly formed periosteal bone (Fig. 11). The anterior third of the footplate is broken into several pieces; the annular ligament has, however, remained intact. The broken pieces of the footplate are embedded in a layer of densely infiltrated connective tissue which posteriorly goes over into the mucosal covering of the posterior portion of the footplate. One of the fragments protrudes slightly toward the lumen of the vestibule, but the endosteum covering the inner surface of the footplate is everywhere intact and thin. On the surface of the central portion of the footplate a thin layer of periosteal bone has been deposited. Near the junction of the anterior crus with the footplate a small piece of bone is seen rotated outward and several very small spicules of bone are displaced into the adjacent connective tissue. There is no evidence of callus formation around the broken fragments. The lower end of the displaced anterior crus is impacted into one of the fragments of the broken footplate, but even here no reactive changes are noted.

The inner ear is without pathological changes.

Comments on Cases 14 and 15

In Case 14 the backward rotation of the stapes with protrusion of the posterior half of the footplate into the vestibule was again followed by serous labyrinthitis, localized proliferation of the perilymphatic tissue of the vestibule with new formation of bone and evagination of middle-ear lumen toward the vestibule.

In Case 15 the absence of callus formation around the multiple fractures of the anterior stapedial crus follows the familiar pattern; the formation of a periosteal callus at the inner end of the fracture line through the posterior crus deserves attention.

Although the anterior half of the footplate had been broken into several fragments, no noticeable displacement of the fragments toward the vestibule and no major tear in the endosteal lining of the footplate had occurred. This was evidently the main reason for the absence of reactive changes in the labyrinth.

Rabbit 16 (612).—Young animal. Killed five months postoperatively.

Right ear without pathology.

Left ear: The external auditory meatus contains a large amount of purulent exudate. The drum is completely destroyed. Middle ear and bulla show a severe purulent infection with extensive and still progressive erosion of the bony walls, including the adjacent parts of the bony labyrinthine capsule. In one place the bony erosion has even extended to the endosteum of the cochlea. The malleus is absent, the incus to a large part destroyed. The oval-window niche is filled with granulation tissue;

the bony walls show again osteoclastic destruction, but in other places, in the window niche as well as in the other parts of the middle ear and in the bulla, deposition of a network of newly formed bone is noted. The stratified squamous epithelium of the external auditory meatus has grown into the middle ear. It extends over the tegmen and the granulation tissue in the oval window niche to the promontory; from the floor it has grown into the adjacent part of the bulla.

The stapedial footplate is intact, but its anterior portion is rotated slightly outward, toward the middle ear. Both crura are broken in their upper third, and the capitulum with the two upper fragments together with the lower part of the long process of the incus is pushed inward towards the footplate. No callus formation is seen.

The vestibule is filled with purulent exudate, which extends through the gap between the anterior portion of the footplate and the window frame as well as through the posterior portion of the annular ligament to the outer (tympanic) surface of the footplate and from there to the middle ear lumen. The cochlea shows a diffuse necrotizing, the other parts of the labyrinth a mostly purulent, and only in some small areas necrotizing inflammation. The round-window membrane is destroyed and the purulent exudate in the round-window niche goes over into the exudate present in the lowermost portion of the scala tympani.

In some places progressive bone destruction from the lumen is noted, which in some places has led to the formation of epidural abscesses. A deep walled-off abscess is present in the fundus of the internal auditory meatus. There is no evidence of a diffuse leptomeningitis.

RABBIT 17 (622).—Young animal. Killed five months postoperatively.

Right ear without pathology.

Left ear: The external auditory meatus contains a large amount of desquamated keratinized material. The posterosuperior portion of the drum is markedly retracted and adherent to the outer wall of the bony facial canal and the long crus of the incus. The drum shows in addition a posterior central perforation. The stratified squamous epithelium of the outer surface of the drum grows around the edges of the perforation inward over the inner surface and over the handle of the malleus. Masses of keratin extend through the perforation into the lumen of the middle ear. The mucosal lining of the middle ear and bulla is slightly thickened. The anterior crus of the stapes is broken in two places in its lower half, but there is no dislocation of the fragments and no callus formation. In the anterior third of the footplate a very small piece of bone is broken away from the rest of it and slightly depressed. It is connected with the adjacent bone by strands of connective tissue. The endosteal lining of the vestibular surface of the footplate is intact and thin. The outer half of the anterior portion of the annular ligament is torn and transformed into a cavity containing remnants of the torn fibers and necrotic debris. The covering tympanic mucosa shows a circumscribed thickening over the ligament and contains numerous phagocytes with dark-staining nuclei and foamy protoplasm (Fig. 12). The inner half of the annular ligament is preserved, but its fibers are somewhat stretched.

The inner ear shows no pathology except for a marked atrophy of the upper portion of the spiral ligament and the stria vascularis in the upper

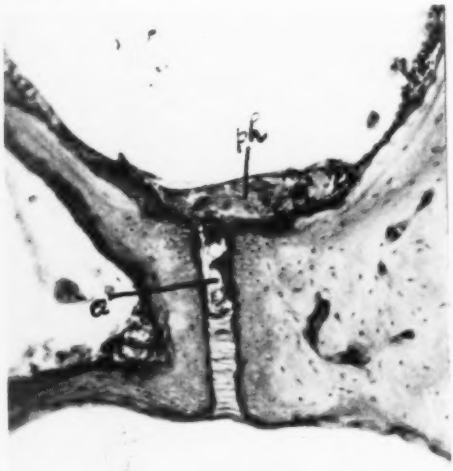

Fig. 12 (Rabbit 17).—Rupture of the outer half of the anterior portion of the annular ligament (*a*). The covering mucosa contains numerous phagocytes (*ph*).

Fig. 13 (Rabbit 17).—Marked atrophy of the upper part of the spiral ligament and of the stria vascularis in the upper basal turn (*a*).

basal turn (Fig. 13). No changes were seen in the vessels in the vicinity of this area. The organ of Corti shows marked but equal postmortem changes throughout the cochlea.

RABBIT 18 (674).—Young animal. Killed five months postoperatively.

Right ear without pathology.

Left ear: The external auditory meatus is filled with a big plug of desquamated keratinized masses and necrotic debris which extends through a large anterior marginal perforation of the drum into the middle ear, the bulla, and into the Eustachian tube. The intact part of the drum is pushed inward and in some places touches the incudostapedial joint and even the medial tympanic wall. The lumen of the middle ear and bulla contains several strands of tissue consisting either of granulation tissue with numerous cholesterol clefts and foreign-body giant cells or of less cellular, more fibrous tissue. Some of the strands adjacent to the necrotic tissue masses consist almost entirely of large polygonal cells with foamy protoplasm and relatively small, dark nuclei. The lining mucosa

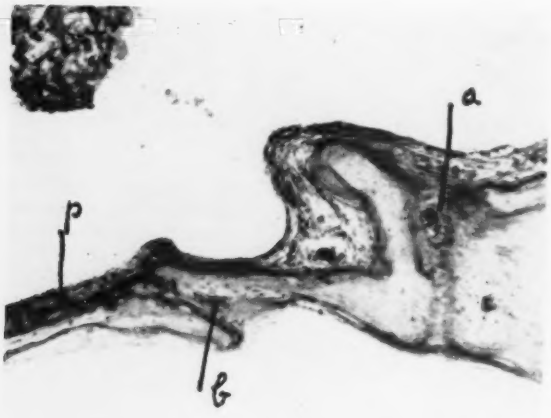

Fig. 14 (Rabbit 18).—Connective tissue with thin-walled blood vessels replacing the torn outer half of the anterior portion of the annular ligament (*a*). Fracture of the footplate healed by bony union (*b*). Thin layer of periosteal bone on the outer surface of the footplate (*p*).

of middle ear and bulla is free from inflammation and covered with cuboidal epithelium.

The lower half of the anterior stapedial crus is missing; some periosteal bone is deposited on the posterior surface of the posterior crus. The anterior portion of the annular ligament is torn in its outer, tympanic half and replaced by connective tissue which contains a thin-walled blood vessel (Fig. 14). The inner, vestibular part of the ligament is still intact. The footplate shows a fracture line through its anterior third; the central portion protrudes for a very short distance laterally along the inner surface of the peripheral portion. Both parts are united by a small amount of newly formed bone. The endosteal lining of the footplate is very slightly thickened but intact. There is a thin layer of periosteal bone deposited to the outer surface of the footplate in the vicinity of the fracture line.

The round-window niche contains the same masses as the middle ear and bulla. They even extend through a hole in the anterior portion of the round-window membrane into the scala tympani of the entire basal cochlear turn. A polypoid mass of granulation tissue consisting mainly of large polygonal cells with foamy protoplasm and containing numerous cholesterol clefts with foreign-body giant cells extends from the niche through the hole in the membrane into the lowermost portion of the scala tympani and for a short distance into the cochlear aqueduct.

Within the lowermost (vestibular) portion of the spiral ligament, immediately underneath the stria vascularis, progressive bone formation is noted in a small, circumscribed area. Otherwise the labyrinth shows only considerable postmortem changes.

Comments on Cases 16-18

In Case 16 the inflammatory changes in middle ear and inner ear are so severe that it has become unsuitable for our present investigation. However, it gives a good illustration of the possible consequences of manipulations on the footplate.

In Case 17 a middle-ear cholesteatoma had developed in the presence of a central perforation of the drum; this is not uncommon in chronic middle-ear infection of rabbits (Wirth, Friedmann). There is practically no dislocation of the broken piece of the footplate toward the vestibule, and again there is neither callus formation nor a reactive proliferation of the perilymphatic tissue of the vestibule. The circumscribed atrophy in the spiral ligament and the stria vascularis is undoubtedly an accidental finding.

In Case 18, again a cholesteatoma has grown into the middle ear, bulla, and Eustachian tube. It has even penetrated through the round window membrane into the basal cochlear turn, thereby causing only a moderate foreign-body reaction.

The formation of a bony callus between the two slightly overlapping portions of the fractured footplate is noteworthy. Reactive changes are absent from the perilymphatic tissue of the vestibule.

The bone formation underneath the stria vascularis of the lowermost portion of the basal cochlear turn is, at least judging from the findings in our other cases, one of the signs of a healed serous labyrinthitis in rabbits, possibly following the ingrowth of the cholesteatoma into the basal cochlear turn. The considerable postmortem changes in the labyrinth do not, however, permit any definite conclusions in this respect.

RABBIT 19 (675).—Adult animal. Killed six months postoperatively.

Right ear: Acute purulent inflammation of the middle ear and bulla. Small, thin deposits of periosteal bone are noted on the posterior stapedial crus.

Inner ear without pathology.

Left ear: The external canal contains a plug consisting of desquamated horny masses and necrotic debris. The drum shows a large perforation which is obstructed by the plug.

The middle ear and bulla show an acute purulent inflammation; several band-like adhesions extend from the inner surface of the drum to the ossicles and into the niche of the oval window.

Some small bone splinters are broken away from the anterior surface of the anterior stapedial crus in its middle portion and lie embedded in connective tissue attached to its periosteum. The continuity of the crus has, however, remained intact. The anterosuperior portion of the footplate is broken away from the rest of the plate and slightly pushed inward toward the lumen of the vestibule. The annular ligament is torn in this area and replaced by granulation tissue. The central portion of the fragment slightly overrides the intact part of the footplate and is connected with it by granulation tissue. Thin deposits of periosteal as well as endosteal bone are noted on the outer and inner surfaces of the fragments, but nowhere are the fragments connected by bone. The endosteal lining of the inner surface of the

footplate is everywhere thin and there is no break in its continuity.

The inner ear is without pathology.

RABBIT 20 (691).—Adult animal. Found dead six months postoperatively.

Right ear shows a beginning purulent infection of the middle ear and bulla.

Left ear: The external canal contains a plug consisting of desquamated horny masses and necrotic debris, which extends through a perforation in the drum into the middle ear.

The middle ear and bulla show a moderately severe purulent infection.

The anterior crus of the stapes is broken near its junction with the footplate; there is no evidence of callus formation. A small portion of the anterior part of the footplate, just behind the anterior crus, is broken away from the remainder of the plate. It is slightly pushed inward and underneath the intact portion of the plate. The endosteal lining is not interrupted. The fragment is connected with the central portion of the footplate by strands of fibrous tissue, with the peripheral portion by a small amount of blue-staining, evidently newly formed endosteal bone. On the outer surface of the central portion of the footplate a thin layer of periosteal bone has been deposited. Similar deposits are found in some places on the concave surface of the posterior crus.

The inner ear is free from pathology.

Comments on Cases 19 and 20

In both cases, there was an evidently recurrent purulent infection of the middle ear and bulla, and the findings at the footplate were almost identical. Nevertheless, a small amount of bone had been formed in a circumscribed area between the fractured portion and the rest of the footplate in Case 20 but not in Case 19. The cause of death in Case 20 remains undetermined; it is, evidently, not related to the changes in the ear.

RABBIT 21 (651).—Adult animal. Killed eight months postoperatively.

Right ear: There is a purulent infection of the middle ear and bulla with intact drum and normal inner ear. Both surfaces of both crura and the tympanic surface of the footplate are covered with a continuous layer of newly formed periosteal bone.

Left ear: The lumen of the innermost part of the external auditory meatus is partially obliterated by connective tissue with formation of multiple epithelium-lined cysts. The tunica propria of the drum is intact in the upper portion only. In the anteroinferior quadrant its continuity is interrupted, and a big plug of connective tissue protrudes from the external meatus into the lumen of the middle ear. On its surface it is covered with markedly proliferated stratified squamous epithelium which has also grown for a short distance around the anterior edge of the perforation forward over the inner surface of the drum. The middle ear and bulla present the signs of a purulent infection of mild degree. The stapes is rotated backward, the incudostapedial joint distended but intact, and the posterior portion of the footplate protrudes into the vestibule. The oval-window niche contains purulent exudate. The anterior crus of the stapes is broken in several places. One bony fragment is slightly displaced inward, another one slightly outward (Fig. 15). Both fragments are connected with the intact parts of the crus by newly formed periosteal bone, which also covers both surfaces of the intact part of the anterior crus. Similarly, an almost continuous thin layer of periosteal bone covers the outer as well as inner surface of the posterior crus. The layer on the inner surface goes over into a thin layer covering the tympanic surface of the footplate (Fig. 15). The annular ligament is torn along its entire circumference. Posteriorly, granulation tissue with small cysts filled with pus has penetrated for a short distance into the lumen of the vestibule; anteriorly, the granulation tissue has also replaced the annular ligament but does not extend into the vestibule. In the center of the footplate the endochondral bone is missing in a small area. The defect is filled out by two layers of newly formed periosteal bone, which are separated from each other by an apposition line (Fig. 15). The perilymphatic tissue in the vestibule is markedly proliferated, covers the granulation tissue which has penetrated into the vestibule, and extends over the posterior two-thirds of the inner surface of the footplate. Extensive and still progressive bone formation is noted in the proliferated perilymphatic tissue. It also extends over the posterior two-thirds of the footplate and is particularly marked over the break in the continuity of the endochondral portion (Fig. 15).

The inner ear otherwise shows the typical signs of a healing severe serofibrinous labyrinthitis with almost complete destruction of the end-organs.

RABBIT 22 (664).—Adult animal. Killed eight months postoperatively.

Right ear: The middle ear shows a low-grade purulent infection. The drum is intact. There are small deposits of periosteal bone on the inner surface of both crura and in the center of the footplate of the stapes. Marked postmortem changes are noted in the inner ear.

Left ear: The external auditory meatus contains a large amount of desquamated layers of keratin. The drum is intact and retracted.

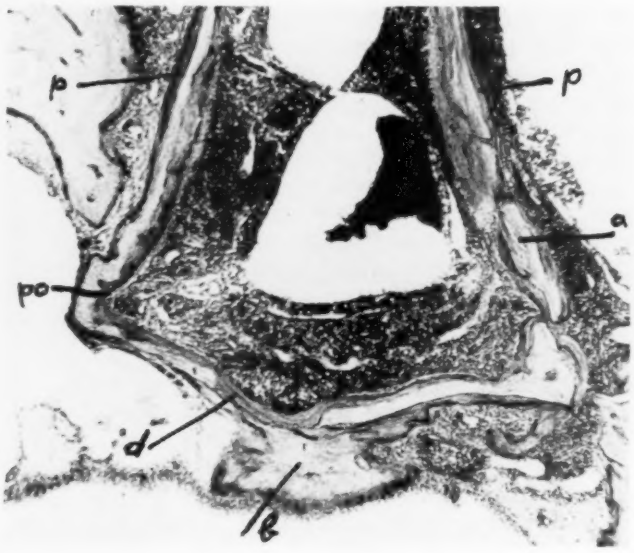

Fig. 15 (Rabbit 21).—Posterior half of the stapedial footplate (*po*) pushed slightly into the vestibule. Both crura and the outer surface of the footplate covered with a layer of periosteal bone (*p*). Piece of broken anterior crus (*a*) displaced outward and connected with the intact part by periosteal bone. Defect of enchondral bone in the center of the footplate (*d*), filled with periosteal bone. Newly formed bone (*b*) in the proliferated perilymphatic tissue.

The middle ear and bulla show the same low-grade infection as on the other side. The incus has lost its connection with malleus and stapes and is pushed backwards. The capitulum of the stapes has been pushed backward against the wall of the facial canal. The anterior crus of the stapes has been broken into several pieces which are united by connective tissue only. The anterior half of the footplate is also shattered into several pieces; one of them, near the rim of the footplate is slightly depressed into the vestibule. Around the depressed piece, there is a slight proliferation of the endosteal lining of the inner surface of the footplate but no interruption of its continuity. There is some new formation of bone around the depressed fragment, through which the latter has become reunited with the rim of the footplate and adjacent fragment. The latter, however, is connected with the intact part of the footplate by strands of connective tissue only. Some periosteal bone has been deposited on the inner surface of the posterior stapedial crus but none on the outer surface of the footplate.

The inner ear shows marked postmortem changes, but no other pathology.

Comments on Cases 21 and 22

Both cases show a purulent infection of the middle ear which was severer in Case 21. In both cases there were multiple fractures of the anterior stapedial crus, but only in Case 21 was there new formation of periosteal bone around fragments; the operative defect of the endochondral bone in the footplate, evidently the result of an incomplete penetration of the needle during the operation, was also filled out with periosteal bone. The displacement of the posterior half of the footplate into the vestibule was followed by a severe serofibrinous labyrinthitis, and marked proliferation of the perilymphatic tissue of the vestibule with extensive new formation of bone, but not by an evagination of the middle-ear lumen into the vestibule, as in the other cases. The slight displacement of one of the fragments of the broken footplate in Case 22 caused a proliferation of the endosteal lining with bone formation around this particular fragment but not the other fragments.

General Comment

Altogether 22 cases were studied, but the first 5 cases, in which the interval between operation and death did not exceed 15 days, do not contribute very much to our knowledge of the reactive bony changes following experimental fractures of the stapes. The following analysis is, therefore, based mainly on the findings in the 17 cases which were examined one to eight months after operation.

In six of them a part of the anterior crus had been removed and in eight it had been fractured. Four times the posterior crus had simultaneously been broken at the time of operation. Once the posterior crus alone had been fractured and twice none of the crura.

Among the eight cases with fracture of the anterior crus, bony callus formation was seen only once (Case 21), eight months after operation. In the five cases with fracture of the posterior crus, callus formation was again seen only once, four months after operation.

The footplate had been fractured in all but two of the cases. Seven times there was callus formation with bony reunion of some or all of the fragments. No callus formation was seen in eight cases (Cases 6, 8, 9, 11, 12, 13, 15, 17).

Eight times a marked proliferation of the perilymphatic tissue in the vestibule was seen with new formation of bone in the vicinity of the footplate which had already or would have eventually caused a bony fixation of the latter from the inside. Altogether such changes were found eight times, five times among the eight cases without bony callus formation around the fragments of the footplate. Only three of the latter (Cases 6, 15, 17) were, therefore, really free from any evidence of new formation of bone from one cause or the other. One of them was, however, only one month after the operation, and the possibility that a bony callus could have formed later cannot be completely excluded.

Proliferation of the perilymphatic tissue in the vicinity of the footplate was observed either in the course of a severe diffuse infection of the whole labyrinth or as the result of a localized infection or aseptic irritation, particularly around bone chips pushed into the vestibule.

Another stimulus for localized tissue proliferation is furnished by large tears in the endosteal lining of the footplate. Small tears heal in a short time, either with formation of a small plug of fibrin and red blood cells (Case 3) or just by endosteal proliferation (Case 4). In Case 5, examined 15 days after operation, the break had already healed without leaving any trace. In other instances, the endosteum becomes slightly thickened. Large tears are closed by circumscribed proliferation of the perilymphatic tissue; frequently the gap is not sealed at the level of the break in the endosteum, but the middle-ear lumen extends with a short recessus into the proliferated perilymphatic tissue (Cases 9, 11, 13).

Careful avoidance of postoperative infection, of displacement of bone chips into the vestibule, and of large tears in the endosteal lining are, therefore, of the utmost importance.

Since no antibiotics were used postoperatively except insufflation of an antibiotic powder at the time of operation and since no sterile technique was used, it seems remarkable that in 9 cases out of 17, and if the 2 cases in which a middle-ear infection had been present at the time of operation are eliminated, in 9 cases out of 15, no evidence of active or healed infection of the labyrinth had been present.

It is beyond the scope of this investigation to discuss the histologic changes observed in the course of the labyrinthine infection. Two findings only will be mentioned: a circumscribed atrophy of the upper portion of the spiral ligament and of the stria vascularis in the upper basal cochlear turn without recognizable accompanying vascular changes (Case 17), for which no explanation could be found, and the bone deposits in the upper part of the spiral ligament of the basal cochlear turn in the vicinity of the stria vascularis in four cases, which could possibly be related to the healing of mild labyrinthine infections.

Middle-ear infections are quite common in rabbits and it is, therefore, difficult to evaluate their influence upon the healing of stapedial fractures. Acute middle-ear infections immediately following the operation seem to be very common and were

found in the four cases examined one and one-half to seven days after the operation but not any more in Case 5, two weeks after operation. In 7 of the remaining 17 cases, there was evidence of active middle-ear infection; since the infection was bilateral in 5 of them, the question must remain open in how many of them it was actually caused by or connected with the operation.

Again, a discussion of the histologic changes in the middle-ear infections would be beyond the scope of this paper. They are essentially not different from those reported in rabbits by Wirth, Friedmann, and others. Cholesteatoma formation, which in rabbits is not uncommon also in cases with central perforations, was seen in four cases. In one of them (Case 18) the cholesteatoma had even penetrated through the round-window membrane into the basal cochlear turn without causing more than a moderate foreign-body reaction.

The great proportion of cases in which a bony callus had been formed in the footplate of rabbits is somewhat surprising in view of the rarity of callus formation in man. The endochondral bone of the footplate itself never produces bony callus; the role played by longer lasting middle-ear infections in stimulating bony callus formation consists, therefore, most probably in stimulating the proliferation of the two layers which are capable of bone production, the endosteum and the periosteum. As a matter of fact, the newly formed bone originated in almost all the cases in the proliferated endosteum; only once (Case 19) the periosteum also participated in the bone formation. It has already been mentioned that periosteal bone deposits on the stapedial crura and occasionally also on the footplate were found only in cases with long-lasting middle-ear infections, not only in the ear operated on, but also in the opposite ear (Cases 19, 21, 22).

If one reviews the cases from that point of view, one finds that among the eight cases with fracture of the footplate without callus formation, there were four times no evidence of middle-ear infection, twice evidence of residua, and twice of active infection. Furthermore, among the five cases without any signs of active or past middle-ear infection there was only once (Case 7) callus formation in the footplate. In spite of the small number of cases observed, the differences between the two groups are impressive. Labyrinthine infection does not seem to influence bony callus formation in the footplate. Among the nine cases without definite evidence of labyrinthitis callus formation was absent four times, but present five times; on the other hand among six cases with evidence of present or past labyrinthitis, callus formation was present in two and absent in four cases.

Among the six cases with fracture of the anterior crus without callus formation, there were five times active middle-ear disease present and once residua. Active infection was also seen in the case with callus formation. In the four cases with fracture of the posterior crus without callus formation, there was once an active infection present, once residua, and twice no infection at all. In the case of fracture of the posterior crus with callus formation, active middle-ear infection was observed.

The great importance of infection for the stimulation of bone growth at the footplate is another reason for careful avoidance of postoperative infection. The frequently observed fact that the hearing gain after stapes mobilization is usually lost if an even transitory middle-ear infection develops, could, at least in some instances, be due to the stimulating effect of the infection on the osteogenetic potencies of the endosteum and to a certain extent also of the periosteum.

The significance of middle-ear infection in the genesis of labyrinthine infections is self-evident and needs no further elucidation.

Circumscribed proliferation of the perilymphatic tissue with subsequent bone formation, particularly around bone chips, as observed frequently in our cases, has re-

peatedly been reported in experimental fistulas in the lateral semicircular canal of animals (Shambaugh and Fowler Jr.) or in human fistulas either after inadvertent operative trauma (Altmann) or after fenestration operations.

In view of the proclivity of the perilymphatic tissue to respond to stimuli of various kinds with circumscribed proliferation and subsequent bone formation, one often wonders if always enough consideration is given to this fact by all the authors who advocate more drastic procedures on the footplate, such as chiseling or drilling through the otosclerotic focus or around it or slight inward displacement of the mobilized footplate, etc.

In a second series of operations antibiotics are being used to prevent, as far as possible, postoperative infections. The results of these investigations will be published at a later date.

Summary

Fractures of the anterior and in some instances of the posterior stapedial crus and of the footplate were produced in rabbits and the histologic changes studied and analyzed in 22 rabbits, examined one and one-half days to eight months after operation.

Bony reunion of the fragments in fractures of the crura is rare; it occurred once in eight fractures of the anterior and again once among five fractures of the posterior crus.

In fractures of the footplate bony reunion of the fragments is much more frequent and was seen seven times in 15 cases.

In crural fractures the callus is produced by the proliferated periosteum, in footplate fractures mainly by the endosteum and to a much smaller extent by the periosteum.

Proliferation of the vestibular perilymphatic tissue in the vicinity of the fracture of the footplate is also very common and was seen in 8 out of 15 cases. Bone formation within the proliferated tissue, particularly around bone chips pushed into the vestibule, is almost the rule and can lead to a fixation of the footplate from the inside.

Such changes were altogether observed in eight cases. Five times they occurred in the eight cases with footplate fractures without callus formation: in this way only three of the latter were actually free from bone formation from one cause or the other.

Proliferation of the perilymphatic tissue occurs in the course of healing of a postoperative infection of the labyrinth. Small tears in the endosteal lining of the footplate are closed by endosteal proliferation and heal without, sometimes with, a slight thickening of the endosteum. Larger tears are closed by proliferated perilymphatic tissue into which not seldom a recessus of the middle-ear lumen extends.

The most important factor in bringing about bony callus formation in the footplate is middle-ear infection which stimulates the osteogenetic potencies of the endosteum and sometimes also of the periosteum. No such influence is seen in crural fractures.

Careful avoidance of postoperative middle-ear infections, of large tears in the endosteal lining of the footplate, and of displacement of bone chips into the vestibule seems, therefore, absolutely essential for the prevention of bony callus formation in the stapedial footplate and of proliferation of the perilymphatic tissue with subsequent bone formation in it.

10 E. 85th St. (28).

BIBLIOGRAPHY

Altmann, F.: Healing of Fistulas of the Human Labyrinth, Arch. Otolaryng. 43:409, 1946.

——— and Waltner, J. G.: Slight Operative Injuries of the Stapes, Arch. Otolaryng. 42:42, 1945.

Basek, M., and Fowler, E. P.: Anatomical Factors in Stapes-Mobilization Operations, A. M. A. Arch. Otolaryng. 63:589, 1956.

Brunner, H.: The Attachment of the Stapes to the Oval Window, A. M. A. Arch. Otolaryng. 59:18, 1954.

Fowler, E. P., Jr.: Otosclerosis in Ultraviolet Light, Ann. Otol. Rhin. & Laryng. 43:408, 1934.

Closure of Operative Fenestrae in Labyrinth, Arch. Otalaryng. 34:209, 1941.

—— and Applebaum, E.: Bone Studies in Ultraviolet Light: I, Anat. Rec. 55:23, 1932.

Friedmann, I.: The Comparative Pathology of Otitis Media—Experimental and Human: I. Experimental Otitis of the Guinea Pig, J. Laryng. & Otol. 69:27, 1955.

II. The Histopathology of Experimental Otitis of the Guinea Pig with Particular Reference to Experimental Cholesteatoma, ibid. 69:588, 1955.

Haag, E.: Über den Bau der Labyrinthkapsel einiger Affenarten, Arch. Ohren- Nasen- u. Kehlkopfh. 136:14, 1933.

Hafner, K.: Die knöcherne Labyrinthkapsel der Nagetiere (Kaninchen, Meerschweinchen, Maus und Ratte), Arch. Ohren- Nasen- u. Kehlkopfh. 137:282, 1933.

Meyer, M.: Über eine eigentümliche Art von Knochengewebe beim erwachsenen Menschen (den lamellenlosen, feinfaserigen [strähnenartigen] Markknochen) und über den embryonalen Markknochen, Ztschr. ges. Anat. 83:734, 1927.

Die normale Anatomie der Labyrinthkapsel, Ztschr. Hals- Nasen- u. Ohrenh. 34:3, 1933.

Oesterle, F.: Über den Feinbau der Gehörknöchelchen und seine Entstehung, Arch. Ohren- Nasen- u. Kehlkopfh. 135:311, 1933.

Shambaugh, G. E., Jr.: Fenestration Operation for Otosclerosis, Acta oto-laryng. Supp. 79, p. 1, 1949.

Wilhelm, E.: Über den feineren Bau der knöchernen Labyrinthkapsel von Hund und Katze, Arch. Ohren- Nasen- u. Kehlkopfh. 136:24, 1933.

Wirth, E.: Experimentelle Untersuchungen zur Bakteriologie und Pathologie der chronischen Mittelohrentzündungen, Ztschr. Hals- Nasen- u. Ohrenh. 37:316, 1935.

Wolff, D.: Microscopic Examination of Human Labyrinths from Patients Exposed to Loud Noises, Arch. Otolaryng. 36:843, 1942.

Wustrow, F.: Über die Anordnung und den Verlauf der Fibrillen im Strähnenknochen der Gehörknöchelchen, Ztschr. Laryng. Rhin. Otol. 35:544, 1956.

Lichtmikroskopische und elektronenmikroskopische Untersuchungen der Fibrillen in den verschiedenen Knochenarten der Gehörknöchelchen, Ztschr. Laryng. Rhin. Otol. 35:689, 1956

CORRECTION

In the article "Arteria Stapedia, in Bilateral Persistence, by Dr. George Kelemen, in the June issue, the second sentence of the first paragraph (p. 668) should read: "A total of 12 relevant observations became known." The second sentence of the "Summary" (p. 676) should read: "Since the first report was given, by Hyrtl in 1836, this is the 13th and the 14th observation respectively."

Audiology Section

JOSEPH SATALOFF, ASSOCIATE EDITOR

Research in Normal Threshold of Hearing

MAJOR JAMES P. ALBRITE (MC), U. S. Army; R. EDWIN SHUTTS, Ph.D.; MAURICE B. WHITLOCK Jr.; RICHARD K. COOK, Ph.D.; EDITH L. CORLISS, M.S., and MAHLON D. BURKHARD, M.S., Washington, D. C.

The results of the 1935 and 1936 United States Public Health Survey have been used as the basis in determining American standards for the threshold of normal hearing. Results of several investigations, including one by Dadson and King in 1952, suggest a significant discrepancy between their data and their interpretation of the current American standards. Translation of the United States Public Health Survey threshold data to sound pressures at the entrance to the ear canal can be made from recent measurements; this reduces the apparent discrepancy considerably, although it does not remove it.

The Dadson-King study raises several questions. First, can the threshold of hearing be related to locality? Second, can the discrepancy be explained on the basis of the differences in the selection of subjects? Third, can testing conditions account for the difference in results? Fourth, can the difference in response be due to the individual characteristics of the earphones used?

Submitted for publication Nov. 14, 1957.

Presented at the Sixth International Congress of Otolaryngology, Washington, D. C., May 10, 1957.

Director, Audiology and Speech Center, Walter Reed Army Hospital (Major Albrite), Assistant Director (Dr. Shutts), Supervisor, Electro-Acoustics Section (Mr. Whitlock), Audiology and Speech Center, Walter Reed Army Hospital; Chief of Sound Section (Dr. Cook), Physicists (Mrs. Corliss and Mr. Burkhard), National Bureau of Standards. Now at the Armour Research Foundation, Chicago (Mr. Burkhard).

In an attempt to answer these questions, 25 male and female subjects ranging from 18 to 26 years of age were investigated. Controls similar to those of Dadson and King were used. Only those whose family history, personal history, and examination were negative for deafness, ear infection, and ear surgery were selected.

The equipment consisted of a beat-frequency oscillator, the output of which was led through a modulating amplifier to a 1 db. step attenuator which controlled the intensity of the stimulus as delivered to the earphone (Fig. 1).

Since one of the purposes was to determine whether any difference existed in the earphones used, both the British (Type 4026A) and the American (Type 705A) were employed. The 4026A British Standard earphone was calibrated by the National Physical Laboratory in England, and, for comparison, the calibration was

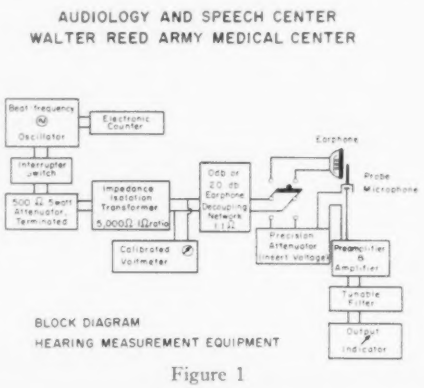

Figure 1

Figure 2

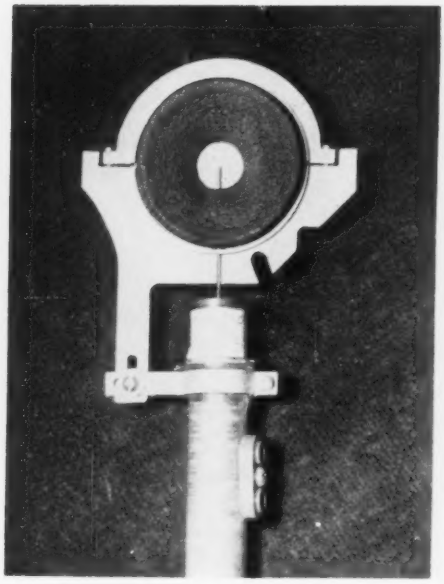

Figure 3

repeated by the National Bureau of Standards in the United States. The National Bureau of Standards also calibrated the Standard American earphone, the 705A.

Each earphone was attached to a rigid aluminum frame which included an open dummy phone for the ear not being tested. This frame contained a means of controlling the lateral force exerted by the earphones (1400 gm. for the 705A and 450 gm. for the 4026A). There was also a means of controlling the weight exerted by the head set (Fig. 2).

A calibrated 640 AA condenser microphone was coupled to a stainless steel tube, the outside diameter of which was 1 mm. and the length 6.2 cm. This probe tube was rigidly mounted in the cushion of the earphone parallel to the diaphragm and ended at the center of the earphone. With this probe tube microphone it was possible to determine the sound-pressure level at the entrance of the external auditory canal (Fig. 3).

For each earphone the following 12 frequencies were tested: 80, 125, 250, 500,

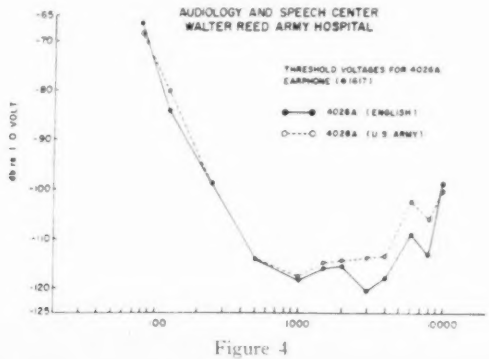

Figure 4

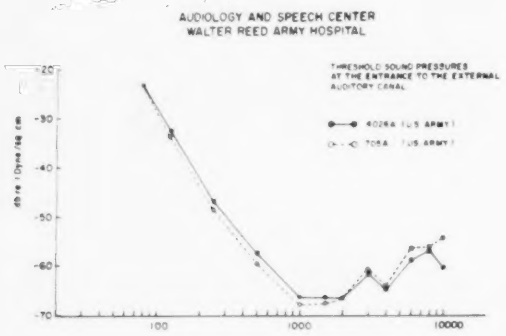

Figure 5

1000, 1500, 2000, 3000, 4000, 6000, 8000, and 10,000 cps.

The initial tone was presented at a sufficiently audible level to acquaint the subject with the type of sound to which he was expected to respond. The intensity of the stimulus was attenuated in 5 db. steps until the subject no longer responded. The attenuation was then alternately increased and decreased in 2 db. steps until the threshold had been crossed three times in each direction. The threshold was defined as the average of six threshold crossings—three descending and three ascending. The duration of the sound was approximately three seconds, and the intervals between the stimuli ranged from one to five seconds. The initial presentation of frequencies was varied from subject to subject in an attempt to equalize any systematic influence in learning and fatigue.

Figure 4 shows the threshold voltage across the same 4026A earphone, and indicates close agreement between our measurements and those of the British.

Our results also indicate that locality apparently does not affect threshold determination when similar controls are used in the selection of subjects and in testing conditions.

Figure 5 gives the sound-pressure levels at the entrance to the external acoustic meatus as measured by us on the 4026A and the 705A earphones. There appeared to be no significant difference in the sound-level pressures required to produce threshold sensation when either phone was used, except at the high frequencies where the standing wave pattern in the ear canal may be responsible. Since the probe is held in place by securing it through a hole drilled in the earphone cap, the position of the

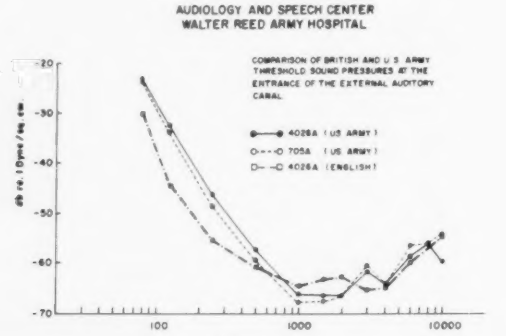

Figure 6

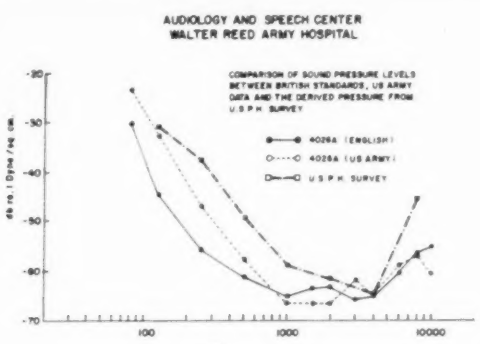

Figure 7

probe relative to the subject's tympanic membrane is influenced by the contour of the earphone cap. Thus their relationship is dependent upon the type of earphone used.

Figure 6 shows the sound-pressure levels reported by the British for the 4026A earphone.

A comparison of the United States Army and British data on the threshold sound pressures reveals an appreciable discrepancy, especially at the low frequencies.

The British standards, the United States Army data, and the sound-pressure levels derived from the United States Public Health Survey are summarized in Figure 7. The threshold pressures from the United States Public Health Survey data are derived from a probe measurement of sound pressures in the ear canal made at the National Bureau of Standards by Corliss and Burkhard. There is a fairly consistent difference of approximately 10 db. between the United States Army threshold determinations and those derived from the results of the United States Public Health Survey.

In general, the results obtained independently by the British and the United States Army are in close agreement on threshold voltages for the type 4026A earphone. Significant discrepancies, however, appear only in the sound-pressure measurements. This disagreement may be due to differences in calibrating techniques employed by the National Physical Laboratory and the National Bureau of Standards. To support this, it may be noted that the voltage readings obtained by the United States Army were similar to those obtained independently by Dadson and King on the same earphone (4026A, No. 1617).

Our findings rule out the factors of locality, selection of subjects, and testing conditions as a possible explanation for the discrepancy. Furthermore, since our laboratory found that the British and American earphones agreed closely in terms of sound-pressure measurements, differences in the earphones themselves cannot account for the disagreement.

The disagreement appears to be a matter of calibrating techniques to be resolved by the National Bureau of Standards in the United States and the National Physical Laboratory in England.

The discrepancies between results obtained by the United States Army and the British as opposed to the current American standards may well be explained on the basis of difference in laboratory and survey type procedures.

Technical assistance was rendered by Robert A. Butler, Ph.D.; F. Thomas Galloway, M.A., and Pfc. William M. Altemus, U. S. Army.

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REFERENCES

1. Dadson, R. S., and King, J. H.: A Determination of the Normal Threshold of Hearing and Its

Relation to the Standardization of Audiometers, J. Laryng. & Otol. 66:366-378 (Aug.) 1952.

2. Corliss, E. L. R., and Burkhard, M. D.: A Probe Tube Method for the Transfer of Threshold Standards Between Audiometer Earphones, J. Acoust. Soc. America 25:990-993 (Sept.) 1953.

3. Corliss, E. L. R., and Snyder, W. F.: Calibration of Audiometers, J. Acoust. Soc. America 22: 837-842 (Nov.) 1950.

4. Albrite, J. P., and Shutts, R. E.: Research in Normal Threshold of Hearing, Sixth International Congress of Otolaryngology, 1957, pp. 126-128.

Loudness, Recruitment, and Differential Diagnosis

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As defined in American Standard Acoustical Terminology,[1] "Loudness is the intensive attribute of an auditory sensation, in terms of which sounds may be ordered on a scale extending from soft to loud." In the normal human ear, this scale has been found to extend from a threshold level of detectability (the acoustic reference level of 0 db. = 0.0002 dynes/cm.^{2} in sound pressure) to a level designated as the threshold of feeling (approximately 140 db.). Between these two defined limits lies a psychological continuum related to the physical intensity scale, but not identical with it. The relationship established between the measurable physical units and the observable psychological units constitutes the *loudness function*.

In the pathological human ear, the dimensions of these psychological units are sometimes found to differ substantially from those normally observed. The term *recruitment* has been employed in reference to these abnormalities in loudness function, and the present discussion represents an attempt to evaluate the methods which have been devised to measure them.

With respect to the nervous system, *recruitment* is used to describe the phenomenon whereby many reflexes, either excitatory or inhibitory in nature, gradually increase to a maximum as a stimulus is prolonged, even though its intensity remains unaltered.[5,20] The phenomenon reflects activation of an increasing number of excitatory or inhibitory neurons.

In audition, the term refers to a phenomenon observed in certain types of hearing impairment whereby, at suprathreshold levels, the growth of auditory sensation is excessively rapid with respect to normal. Indeed, at levels only moderately, and sometimes even slightly, above the intensity threshold, the subjective loudness in a "recruiting" ear may be reported as equal to that in a normal ear.

The phenomenon of accelerated growth of loudness was first reported in the literature by Pohlman and Kranz as follows:

"Decreased acuity of hearing for certain limited portions of the tone scale as determined by minimal audible sounds, is not a criterion of deafness with respect to ordinary intensities. Once the threshold of such a range of decreased acuity is attained, it takes comparatively little additional energy to cause the deficiency to seemingly disappear quite completely." *

It was not until 1928, when Fowler first used the term "recruitment" and suggested a method of measurement, that clinical investigation into abnormal loudness function became a matter of general concern in the field of audition. Fowler has characterized the phenomenon as *recruitment of loudness*, since, in his concept, the "varying differences in loudness necessary for balance" (i. e., between a normal and an impaired ear in the same individual) . . . "at the various steps above thresholds are the measure of the rates of recruitment of the neural elements necessary for equal balance. They are, therefore, a measure of the location, number, and extent of loss of the neural elements which either initiate, conduct, or relay impulses from the end-organ to the cortex." †

Since 1928, there has been increasing interest in the significance and measurement of this concept of "recruitment," at first as a means of differentiating between

Submitted for publication Oct. 15, 1957.

* Pohlman and Kranz,[22] p. 337.

† Fowler,[13] p. 202.

losses of neural or non-neural origin, and more recently, as a means of differentiating between peripheral and central lesions.

It is an unfortunate fact that the protection naturally afforded to inner ear structures by their anatomic inaccessibility makes accurate differential diagnosis a major problem. Otoscopic examination and improved x-ray techniques can define lesions in the external and middle ears, but lesions resulting from pathological processes which produce their sole effects in the cochlear and neural structures cannot, at present, be disclosed for examination in a living subject. The importance of functional tests in differential diagnosis derives directly from this fact.

There are several techniques for the differential measurement of function presently at our disposal, and the growing interest in recruitment and its measurement must be considered in light of their values and limitations. In conjunction with otologic findings, known history, and the observed performance of a patient, audiologists rely primarily upon information derived from pure-tone and speech audiometry, i. e., the shape of the audiogram, the relations between air- and bone-conduction thresholds, articulation scores, and the like.

The value of present standard measures in differential diagnosis is attested by a growing body of knowledge concerning the relations between specific kinds of pathology and their functional manifestations. These relations permit generalizations on the basis of a rounded clinical picture; they do not lend themselves easily or precisely to such diagnostic refinements as specifying the site of a lesion, or distinguishing among the effects of lesion at more than one site. All too often, persons who have similar audiograms function in very dissimilar fashion. There is a clear need for procedures which will enable us to clarify these differences further, and to determine, insofar as possible, the mechanisms which operate to produce them. Because measurement of recruitment has seemed to offer, at the least, a supplement to standard procedures and, at the most, the possibility of clarifying unresolved problems, numerous procedures have been developed, and various hypotheses advanced, to explain their apparent results.

Standard Procedures

A competent and experienced audiologist can demonstrate the existence of abnormal loudness function solely on the basis of qualitatively deviant performance during standard procedures, and without recourse to special tests. Let us assume two hypothetical patients, one of whom, A, has normal loudness function, and the other of whom, B, seems abnormally sensitive to suprathreshold sound, and compare them in terms of some of these procedures:

Pure-Tone Audiometry.—For A and B alike, threshold sensation may be considered the same insofar as it is the point of minimal perceptibility. However, if the intensity of the stimulus is increased by 5 db., A will report, upon inquiry, that the sound is still "very soft," while B may often volunteer the information, "That's loud!"

Speech Audiometry.—A may have a speech-reception-threshold of 50 db. re normal, but if the intensity of speech is increased to a level which is approximately 30 db. above this, he will be able to discriminate among test words just about as well as a normal hearer. B may have the same amount of threshold impairment for speech, but he will have considerable difficulty in discriminating among test words even though the intensity level is comfortably above his threshold; it is unlikely that his discrimination will be improved if the intensity is further increased; indeed, it may deteriorate.

Amplification Use.—Assuming selection of the proper ear for amplification, a suitable instrument, and adequate guidance, A will function well with a hearing aid; his speech-hearing-threshold will generally be

improved by 30 db. or more, and his excellent discrimination will be maintained under conditions of both quiet and noise. It is probable that he will use his aid during all or most of his waking hours. B, on the contrary, may find the hearing aid more annoying than helpful, except perhaps in highly selected listening situations. Upon initial exposure, he will find it difficult to tolerate amplified sound, or will find the added loudness confusing: even with continued exposure, his tolerance will not be appreciably improved. His gain from amplification will be minimal, and though his discrimination may not suffer noticeably under conditions of quiet, it will deteriorate markedly in the presence of noise.

A brief summary of this type is, of course, vastly oversimplified, but it serves to illustrate the ease with which abnormal sensitivity to loudness can be detected by a trained observer. It also illustrates the limitations of such qualitative demonstration since there is no way to determine quantitative aspects: if the sound 5 db. above thresholds is "loud," how loud is that in relation to the normal characterization of the same level above threshold as "very soft"? It seems obvious that the difficulty in discrimination and the inability to tolerate amplification are in some way related to the sensitivity to loudness, but it seems equally obvious that the relationship is not a simple one. "Recruitment" tests are the outgrowth of attempts to quantify these observable qualitative differences and to utilize the ascertained values in differential diagnosis.

Existing techniques for "recruitment" measurement may be considered in terms of two general methods of approach: Loudness balance tests constitute a direct measure, comparing the growth of sensation in an affected ear or at an affected frequency with the normal; difference limen (DL) tests measure function indirectly, the rationale being that, when the growth of sensation is accelerated, the increments (or intensity DLs) will be smaller than those normally observed.

Loudness Balance Tests

1. Fowler's originally suggested technique[13] of *Binaural Loudness Balance* is applicable only to unilateral loss. It is based upon the alternate presentation of tones to the impaired and normal ear until, by a process of trial and error, the patient reports the tones to be equally loud in both ears (i. e., balanced). Determinations are made at various intensity levels, most of which are well above the threshold of audibility. The observable differences in acceleration of loudness constitute a quantitative measure which can be plotted on a "phantom ladder graph."

Aside from the unfortunate fact that relatively few perceptive losses are unilateral, the test is time-consuming and requires a considerable degree of subjective judgment about sound from listeners who have difficulty even in much simpler listening situations.

2. *Interfrequency Loudness Matches*[7,33] or *Monaural Loudness Balance Tests*[14] represent modifications of the binaural technique with a view to extending applicability to bilateral impairment. The acceleration for a frequency at which "recruitment" is suspected is compared with another in the same ear which is assumed to be normal.

While a procedure of this sort achieves its purpose of extended applicability, it compounds the listening problems inherent in the binaural test and presumes the existence of normal loudness function for a control frequency in an ear with demonstrable dysfunction at other frequencies. That this may in fact be the case is not unlikely, but in the absence of some criterion for the control, it is also possible that the findings merely represent a comparison between differing degrees of dysfunction.

3. The *de Bruine-Altes Masking Method*[6] is another modification of the binaural

loudness balance test. The effect of opposite ear masking by a low frequency constitutes the "recruitment" measure. The determination is made at several intensity levels, and the method of quantification is similar to that suggested by Fowler, though somewhat more complex.

Like the parent Fowler technique, the method is limited to measurement of unilateral impairment. Its somewhat dubious advantages are small compensation for the elaborate equipment and procedures entailed in its use.

4. Watson and Tolan's *Range of Loudness Method*[36] is probably the simplest technique which has been suggested. Listeners are instructed to make two judgments of loudness as the intensity level of a series of pure tones is increased: the "most comfortable loudness level," or CLL, and the "uncomfortable loudness level," or ULL. The range in decibels between the two judgment points constitutes a quantitative measure.

The procedures are simple, and the only apparatus required is a standard audiometer, but the test has certain disadvantages: 1. It is obvious that "comfort" or "discomfort" can mean different things to different people; indeed, criteria may vary in the same individual under different circumstances. 2. When the degree of threshold impairment is severe (which is not uncommon for frequencies at which "recruitment" is suspected or demonstrable), the output limitations of the audiometer may preclude determination of the ULL, and possibly the CLL as well.

Difference Limen Tests

1. The *Békésy Method*[3,4] necessarily entails use of the Békésy audiometer, a unique apparatus which produces a continuous auditory stimulus of variable intensity; frequency can be adjusted by the examiner to cover either the entire test range or a desired portion of it, at variable rates, and in either ascending or descending sequence. The listener is instructed to press a button when the tone is perceived, and the button automatically engages an attenuator which decreases stimulus intensity until it is released: an automatically traced audiogram provides a visual record of performance. The extent of the recorded excursions on the audiogram not only constitutes a measure of variability around the "absolute" threshold (which is taken as the midpoint), but also a measure of the DL for intensity.

The Békésy technique has three very obvious advantages: rapidity of administration, versatility, and automatism. There are, however, those clinicians who report that the isolated test situation is so psychologically disturbing to many of their patients as to render these assets more theoretical than real. The major disadvantage of the test is the cost of the equipment.

2. The *Lüscher-Zwislocki Method*[28,29] involves audiometric determination of the DL by means of amplitude modulation, the criterion being the "smallest variation in pressure which is just perceived as a change in loudness."‡ The prescribed presentation level is 40 db. above threshold (except when an impairment is too deep to permit this level, in which case the authors suggest that the test may be accurately administered at 15 to 20 db. suprathreshold). Since the rationale for the presentation level is that effects of intensity and frequency are relatively invariable at 40 db., it is somewhat disconcerting to discover that findings may also be considered accurate 20 or 25 db. lower.

There are several serious objections to this frequently used technique: 1. Inasmuch as "recruitment" is more greatly evidenced at levels near threshold, there are many who feel that a measurement so far above it rather defeats its own purpose. 2. While a straight line may be the shortest distance between two points, it does not necessarily follow that loudness increments in a pathological ear pursue so unswerving

‡ Lüscher, p. 1119.

a course over a range of 40 db. 3. Frequent reports in the literature that findings obtained with this method are in conflict with results obtained by a battery of other clinical tests suggest that though the test may be valid under certain circumstances, it is subject to artifact.

3. The *Denes-Naunton Method*[8] is a modification of the Lüscher-Zwislocki technique. Two determinations are made, one at 4, and the other at 44 db. above threshold: the amplitude of modulation is increased, and the tones more widely separated in time to avoid a continuous auditory stimulus. Intensity of the modulated and unmodulated frequencies is gradually equated until the listener reports no difference between them.

The literature evaluating the relative merits of the Lüscher-Zwislocki and Denes-Naunton techniques is sparse. A 1953 review of "recruitment" measures by Bangs and Mullins[2] indicates that in general the Lüscher-Zwislocki is slightly superior, and that neither seems especially accurate or conclusive.

4. The *Jerger Method* or *Northwestern DL Test*[24] is another and simpler version of the Lüscher-Zwislocki technique. In an attempt to decrease auditory after-image, the order of tone presentation is reversed from no modulation to full modulation. The presentation level is 15 db. above intensity-threshold, and the DL is taken as that increment in intensity at which a beat is first discernible to the listener.

Insofar as discussion in the literature may constitute an indication of use, this test is not widely known or applied—a fact which may not necesarily be indicative of its merits. It seems to have certain advantages, though its resemblance to the method from which it derives makes it subject to similar criticisms.

In attempting to evaluate these methods, it is hardly possible to assess them except in terms of their general clinical utility. While each of them has, in some measure, contributed information regarding a function which is widely recognized but little understood, no one of them is standardized.

The terminology of "recruitment," like the tests for it, is also unstandardized. Literature on the subject is a veritable jungle of technical jargon, rife with such terms as "normal recruitment," "regular recruitment," "asymptotic recruitment," and other descriptive phrases. The function itself is known variously as "recruitment," "regression," and "variable hearing loss." It is hardly surprising that Fowler, who first stimulated major interest in the phenomenon, felt constrained to remark in 1950: "The 'recruitment phenomenon,' after twenty odd years, though universally accepted, is still not clear to many otologists. They do not understand the loudness function of the ear."§ A survey of the literature indicates that otologists are not alone in this misunderstanding.

The sole fact on which everyone seems to be in agreement is that this "hypersensitivity" to loudness is most strongly manifested at levels just above threshold. In view of this, it is anomalous that nearly all of the suggested techniques, with the exception of the Békésy, are designed to measure function at levels well above threshold. Reger and Kos, on the basis of some extremely interesting experimental evidence, suggest that tests at suprathreshold stimulation levels are "contaminated" because the high level of stimulation may, in itself, be sufficient to provoke a threshold shift in an ear with abnormal loudness function. "Attempting to measure the degree of recruitment under such conditions is analagous to trying to measure the height of a horse while it is running." The writers also "dare to suggest that the whole field of recruitment measure needs reevaluation . . ."‖ The conclusion is very nearly inescapable.

Though it is a clinically observable fact that "recruitment" is most frequently evidenced at high frequencies,[4,11] some inves-

§ Fowler,[14] p. 680.

‖ Reger and Kos,[24] p. 818.

tigators report that the phenomenon is most frequently exhibited at low frequencies,[30] and others that there are no observable differences as a function of frequency.[29] On the one hand, it is stated that "recruitment" is specifically caused by lesions of the hair cells on the basilar membrance and thus constitutes a means of differentiating between Ménière's syndrome and acoustic neuroma.[9-10,15,17-19,25,26] On the other hand, there is information that "recruitment" is a neural phenomenon, that its presence can be demonstrated in acoustic neuroma [5,14,22] and may not necessarily be demonstrable in Ménière's syndrome.[5,14,25] One study of 113 pathological ears reports that no systematic differences in sensitivity among any of the diagnostic categories were demonstrable with the Lüscher-Zwislocki test.[27]

One must search the literature diligently for evidence of attempts to relate other functional test results with "recruitment" findings. Only three investigators [14,16,35] call attention to the clinically observable fact that loudness sensitivity in a perceptively impaired ear is often accompanied by pitch distortion of various kinds; only three investigators [21,23,31] apply the concept of abnormal loudness function to speech intelligibility.

The conflicting results of present "recruitment" measures lead to the conclusion that no single test constitutes a reliable index for differential diagnosis. The question arises as to whether Fowler may not unwittingly have been instrumental in compounding the confusion by relating his clinical observations somewhat categorically to the function of neural elements. There is no experimental evidence that the loudness function is *solely* contingent upon them, and recent studies [11,15,36] indicate that the hair cells may also play a part. Furthermore, in its neurological application, the term *recruitment* refers specifically to reflex phenomena; its use in terms of hearing apparently negates the fact that auditory perception is, in the final analysis, the end-product of many processes. The functional manifestation of abnormal loudness function assumes many forms, and the use of a generalized description for all of them is an oversimplification.

In the present discussion, it is suggested that the "recruitment" phenomenon reflects a complex of related auditory processes, the fundamental nature of which cannot be delineated by psychoacoustic investigation. If we are to understand the manifestations of these processes more clearly, however, it would seem advisable to isolate the function which is most apparent in the total complex, i. e., loudness; to measure it systematically; and to evaluate the findings in the light of other clinical and functional indices.

Perhaps the most promising method which has been presented to date is that suggested by Miskolczy-Fodor.[30] His work demonstrates that it is possible to utilize the relationship between the intensity and the duration of pure tones in developing a functional curve which indicates the rate at which subjective loudness increases for normal hearers. The variations in normal function can be established within fairly well-defined limits, and it thus becomes possible to quantify the growth of loudness in pathological ears in terms of standardized normal values. Miskolczy-Fodor's findings are well supported by the work of Eisenberg,[11] who examined intensity-duration relationships in a large group of normal and hearing-impaired subjects.

The primary objection to adopting the Miskolczy-Fodor method (or any of the other tests reported) for routine clinical use stems from the fact that interpretation of the findings is of greater importance than the findings themselves. Without knowledge of *what* is being measured, it is difficult to assess the diagnostic implications of the test results.

Summary and Conclusion

The confusion which continues to exist in the field of loudness measurement re-

mains to be resolved by the following measures:

1. Systematic examination of the loudness function in normal as well as in pathological ears
2. Critical evaluation of those test methods which are now in more or less general clinical use
3. Exploration of new avenues of approach
4. Increased investigation of the physiological and biochemical processes underlying the growth of auditory sensation

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REFERENCES

1. American Standard Acoustical Terminology, Acoustical Society of America in Cooperation with Institute of Radio Engineers, Inc., New York, American Standards Association, 1951.

2. Bangs, J. L., and Mullins, C. J.: Recruitment Testing in Hearing and Its Implications, A. M. A. Arch. Otolaryng. 58:582-592, 1953.

3. von Békésy, G.: A New Audiometer, Acta Oto-laryng. 35:411-422, 1947.

4. von Békésy, G.: The Recruitment Phenomenon and Difference Limen in Hearing and Vibration Sense, Laryngoscope, 57:765-777, 1947.

5. Best, C. H., and Taylor, N. B.: The Physiologic Basis of Medical Practice, Ed. 5, Baltimore, Williams & Wilkins Company, 1950.

6. de Bruine-Altes, J. C.: The Symptom of Regression in Different Kinds of Deafness, Thesis, University of Groningen, Holland, 1946.

7. de Bruine-Altes, J. C., and Huizing, H. C.: The Monaural Method for Recruitment Testing in Symmetrical Deafness, Acta Oto-laryng. 37:385, 1939.

8. Denes, P., and Naunton, R. F.: The Clinical Detection of Auditory Recruitment, J. Laryng. & Otol. 64:375-398, 1950.

9. Dix, M. R.; Hallpike, C. S., and Hood, J. D.: Observations upon the Loudness Recruitment Phenomenon with Especial Reference to the Differential Diagnosis of Disorders of the Internal Ear and Eighth Nerve, J. Laryng. and Otol. 62: 671-686, 1948.

10. Eby, L. G., and Williams, H. L.: Recruitment of Loudness in the Differential Diagnosis of End Organ and Nerve Fiber Deafness, Laryngoscope 61:400-414, 1951.

11. Eisenberg, R. B.: A Study of the Auditory Threshold in Normal and in Hearing-Impaired Persons, with Special Reference to the Factors of the Duration of the Stimulus and Its Sound Pressure Level; and a Discussion of the Implications, Clinical and Physiological, of the Reciprocal Relationship Between These Factors, Thesis, The Johns Hopkins University, Baltimore, 1956.

12. Fowler, E. P.: Marked Deafened Areas in Normal Ears, Arch. Otolaryng. 8:151-155, 1928.

13. Fowler, E. P.: Diagnosis of Diseases of the Neural Mechanism of Hearing by Aid of Sounds Well above Threshold, Laryngoscope 47: 289-300, 1937.

14. Fowler, E. P.: The Recruitment of Loudness Phenomenon, Laryngoscope, 60:680-695, 1950.

15. Hallpike, C. S., and Hood, J. D.: Some Recent Work on Auditory Adaptation and Its Relation to the Loudness Recruitment Phenomenon, J. Acoust. Soc. America 23:270-274, 1951.

16. Harris, J. D.; Rawnsley, A. I., and Kelsey, P. A.: Studies in Short-Duration Auditory Fatigue: I. Frequency Differences as a Function of Intensity, J. Exper. Psych. 42:421-426, 1951.

17. Hood, J. D.: Studies in Auditory Fatigue and Adaptation, Acta Oto-laryng., Supp. 92, pp. 1-57, 1950.

18. Hood, J. D.: Adaptation in Disorders of the Inner Ear and Its Relationship to the Loudness Recruitment Phenomenon, Proc. 5th Internat. Cong. Otol. Rhin. & Laryng., Amsterdam, 1953.

19. Hood, J. D.: Auditory Fatigue and Adaptation in Differential Diagnosis of End-Organ Diseases, Ann. Otol. Rhin. & Laryng. 64:507, 1955.

20. Howell's Textbook of Physiology, edited by J. F. Fulton and others, Ed. 15, Philadelphia, W. B. Saunders Company, 1946.

21. Huizing, H. C.: The Symptom of Recruitment and Intelligibility of Speech, Acta Oto-laryng., Supp. 36:346-355, 1948.

22. Huizing, H. C.: The Recruitment Factor in Hearing Tests, Proc. 1st Internat. Cong. in Audiology, Columbia Presbyterian Med. Ctr., 1950, N. Y.

23. Huizing, H. C., and Reyntjes, J. A.: Recruitment and Speech Discrimination Loss, Laryngoscope 62:521-527, 1952.

24. Jerger, J. F.: A Difference Limen Recruitment Test and Its Functional Significance, Laryngoscope 62:1316-1332, 1952.

25. Jerger, J. F.: Differential Intensity Sensitivity in the Ear with Loudness Recruitment, J. Speech & Hearing Disorders 20:183, 1955.

26. Lundberg, T.: Diagnostic Problems Concerning Acoustic Tumors: A Study of 300 Verified Cases and the Békésy Audiogram in the Differential Diagnosis, Acta Oto-laryng., Supp. 99, 1952.

27. Lund-Iverson, L.: An Investigation on the Difference Limen Determined by the Method of Lüscher-Zwislocki in Normal Hearing and Various Forms of Deafness, Acta Oto-laryng. 53:221-260, 1952.

28. Lüscher, E.: The Difference Limen of Intensity Variations of Pure Tones and Its Diagnostic Significance, Proc. Roy. Soc. Med. 43: 1116-1128, 1950.

29. Lüscher, E., and Zwislocki, J.: A Simple Method for Indirect Monaural Determination of the Recruitment Phenomenon (Difference Limen in Intensity in Different Types of Deafness), Acta Oto-laryng. 78:156-168, 1949.

30. Miskolczy-Fodor, F.: Monaural Loudness-Balance Test and Determination of Recruitment-Degree with Short Sound-Impulses, Acta Otolaryng. 43:573-595, 1953.

31. Palva, T.: Studies on Per-Stimulatory Adaptation in Various Groups of Deafness, Laryngoscope 65:829-847, 1955.

32. Pohlman, A. G., and Kranz, F. W.: Binaural Minimum Audition in a Subject with Ranges of Deficient Acuity, Proc. Soc. Exper. Biol. & Med. 21:335-337, 1924.

33. Reger, S. N.: Differences in Loudness Response of the Normal and Hard-of-Hearing Ear at Intensity Levels Slightly above the Threshold, Ann. Otol. Rhin. & Laryng. 45:1029-1039, 1936.

34. Reger, S. N., and Kos, C. M.: Clinical Measurements and Implications of Recruitment, Ann. Otol. Rhin. & Laryng., 61:810-821, 1953.

35. Simonton, K. M.: Diplacusis Binauralis Dysharmonica and Recruitment of Loudness: Their Clinical Significance, Instruction Course No. 476, American Academy of Ophthalmology and Otolaryngology, 1951.

36. Watson, L. A., and Tolan, T.: Hearing Tests and Hearing Instruments, Baltimore, Williams & Wilkins Company, 1949.

37. Wever, E. G., and Lawrence, M.: Physiological Acoustics, Princeton University Press, 1954.

Speech Audiometry Using Magnetic Tape on Cards

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I. Present Modes of Presentation

A controversy among audiologists has existed for some time as to which of the methods of presenting speech materials for various purposes is most desirable. In performing audiometric tests with speech, there are three methods of presentation which may be used. One is "live-voice testing," in which the tester's speech is monitored with a standard sound-level meter. A second, and more frequently used method, is "monitored microphone voice" testing (often misnamed "live-voice testing") in which the examiner reads a list of words through a microphone into a calibrated amplifying system, monitoring each word or a carrier phrase with a VU meter. In the third and most frequently employed mode of presentation, recorded material, either on discs or tape is utilized. Revised lists of spondaic and phonetically balanced words based on material developed at the Harvard Psychoacoustic Laboratory have been prepared by the Central Institute for the Deaf. These tests, numbered Auditory Tests W-1 and W-2 and W-22 are available commercially on disc recordings from Technisonic Studios. They are now used by many institutions in this country for speech audiometry, especially in the conduct of research studies requiring good test-retest reliability.[1] No recorded speech tests are commercially available on spools of magnetic tape. Some institutions use the voice of a staff member to make their own tapes, while others put the Central Institute for the Deaf recordings on tape. Most hearing evaluation units have inputs for both disc and tape.

True live voice, with a sound-level meter is a great strain on the tester's voice, especially at high-intensity levels. The main advantage claimed for monitored microphone voice testing is that it permits the examiner greater control of the test situation, for each patient, than is possible when recorded material is used. With microphone or live-voice testing, the examiner may control the rate at which the material is presented to the patient and may alter the order of presentation of the words on the different lists. Furthermore, directions may be given to the patient during the course of the test. It is reassuring, and often essential, for some patients to have the tests administered by an examiner with whom rapport and confidence have been established. This is particularly important with children, older persons, and patients who are apprehensive in the test situation.

Monitored microphone voice testing, with standard word lists, has become an accepted procedure for complete audiologic examinations and in comparative hearing aid evaluations. The use of the microphone voice method of testing seems to be of great value in the hearing evaluation of older patients having some form of nonperipheral presbyacusis. In such patients, Bordley[2] reports the following characteristics: (1) inability to benefit from amplification; (2) marked differential between the threshold of detectability and the speech reception threshold; (3) an abnormal breakdown of discrimination in noise, and (4) significantly improved discrimination scores when the test material is presented at a slower rate. Such improvement in the discrimina-

Submitted for publication Nov. 15, 1957.

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Presented in part by Dr. Fowler before the American Academy of Ophthalmology and Otolaryngology, Chicago, Oct. 17, 1957.

tion score is best determined by using a method of testing in which the rate of presentation can be readily controlled.

With more flexible means of testing discrimination, it is possible for the clinician to arrive at a more definitive evaluation of the patient's clinical and social discourse problems. Such diagnostic and practical information is also of importance in planning for a program of auditory rehabilitation and in determining the specific therapeutic procedures to be employed in the speech reading and auditory training program. Many clinicians who have worked with problem cases of neural deafness, young and old, are convinced of the value of monitored microphone voice testing.

There are, however, a number of important objections to the use of individually monitored microphone speech tests which are legitimately raised by those who prefer the use of recorded materials. The voice of different examiners introduces many variables into the test situation. These often vitiate the use of monitored microphone voice as a reasonably "objective" or controlled method of evaluating speech reception. There are obvious as well as subtle differences in the speech and voice characteristics of different speakers and of the same speaker at different times. Differences in results of speech audiometric tests may also result from the use of a female rather than a male voice. Observation of the microphone voice of a number of examiners shows that articulation may be quite different at 4:30 in the afternoon from what it is at 10 in the morning. The examiner's mouth distance from the microphone affects both the intensity and the frequency response of the speech material. Considerable skill and care is required to obtain and maintain proper monitoring of the examiner's voice for each word during the test. The emotional and physical condition of the tester and his relation to the patient being examined also affect the quality of presentation of the material. In a lengthy, "standard" hearing aid evaluation,[3] for example, the fatigued examiner, perhaps, anxious that the patient do well so that a specific recommendation may be made, sometimes manifests striking changes in the clarity and precision of his articulation of which he is usually completely unaware. The trained clinician persistently attempts to reduce these variables during the evaluation of the auditory function of his patient. Yet because he is a human being and subject to interruption, anxiety, stress, worry, fatigue, and varying degrees of physical incapacity, these factors enter into and affect the accuracy of his test results. Silverman and Hirsh [4] state that "it is dangerous to base diagnostic determination on measures of discrimination loss that are made with the live voice (microphone voice) presentation of many different clinical workers."

Recorded material permits a degree of consistency and reliability of results not possible with microphone voice testing. Until deterioration of the discs, or tapes, used for testing occurs, the examiner may be certain that within the limits of his equipment and its proper calibration, the patient is getting the same material presented in the same way each time he is tested. Lidén [5] and many others consider recorded speech as the preferred method of test presentation because it ensures greater uniformity of reproduction and makes possible a comparison of examinations conducted at different places (provided the same set of recordings are used). The use of recorded material is certainly the most reliable method of assessing the speech-hearing function of hard of hearing patients. However, for reasons already considered, many clinicians have used monitored microphone voice for much, if not all, of their speech testing.

II. Magnetic Tape on Cards

There has recently been developed an electronic device based on the principles of a magnetic tape playback machine.* The

* The Language Master—commercially available from J. W. Manny, Inc., 48 E. 43rd St., New York.

difference is that the tape is supplied firmly attached to cards rather than on individual spools or reels. A single card bearing this magnetized plastic tape is placed in a groove and pushed against rollers which move it across a sound head instead of having the tape pulled across, as in a conventional machine. The magnetic sound track on each card is amplified in the usual way and can be heard either through the loudspeaker or earphones provided with the machine. As the card with the magnetic tape moves past the playback head a voice speaks the word or words printed on the cards. Therefore, as the card is played, the patient not only hears the word pronounced but also may see the printed word or words and, if desired, an accompanying picture of an object named on the magnetic tape.

III. Speech Audiometry

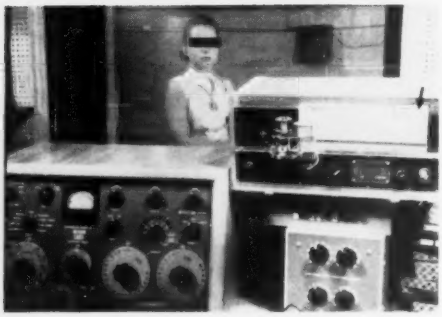
The application of this procedure to the administration of speech hearing tests appears to combine the advantages of both microphone voice and recorded methods of testing. A single spondee or phonetically balanced word is recorded on each card along with a carrier phrase. With each test set, there is a card on which is recorded a 1000 cycle tone for calibration purposes. In advance of each test, the examiner adjusts the gain control of the amplifier to a reference point on the VU meter as he does with standard disc recordings and he is then in calibration for the 50 cards on a given test set.

By modifying the instrument for use as a preamplifier-equalizer[6] through the use of an auxiliary output jack, the examiner can present the specially prepared cards through the amplifier and transducers of his own hearing evaluation unit, thus bypassing the power output stage of the instrument itself as well as that of its transformer. While the normal frequency response of the loudspeaker included with the instrument (300-4200 cycles) is adequate for speech therapy and auditory training, it does not meet the more stringent requirements of discrimination testing in speech audiometry, where a frequency response up to 7000 cycles is desirable. By-passing the later stages of amplification on the instrument does not broaden the frequency response to the desired extent because the preamplifier and power amplifier of the unit remain in the circuit. Another factor which limits the upper end of the frequency range is the slow speed of playback ($2\frac{1}{8}$ in. per second). Therefore, it is necessary to feed the signal directly from the playback head of the instrument to an external pre-amplifier in order to achieve the desired frequency response. It is possible to modify standard hearing evaluation units in use today so that the present instrument may be included in the circuit as an input.

Intensity is controlled by the 1 or 2 db. step attenuator on the hearing evaluation unit. Thus, only the card-feeding mechanism and playback head of the instrument are used when speech audiometric tests are performed. All other controls are those which the examiner usually uses in speech audiometry. A series of cards of the speech audiometric materials are being prepared, based upon the spondaic and phonetically balanced word lists from the Harvard Psychoacoustic Laboratory and the Central Institute for the Deaf.

IV. Method

Prior to the performance of the test, the examiner scrambles a set of cards so that a variety of word orders are possible with a given list. Thus the same list can be used several times during a test without the memory factor affecting the results obtained. This may occur when the testee is familiar with the words. With a two-channel hearing evaluation unit, the input of one channel is set to "Microphone" while the other channel is set for use with the instrument. Both inputs may be fed through a common transducer. The examiner can then communicate with the patient through



Equipment for speech audiometry using magnetic tape on cards.

the microphone during the course of the evaluation while the actual test material is presented via the specially prepared cards. The arrangement of equipment for the test procedure and a patient are shown in the Figure. Thus, the flexibility and spontaneity of the test situation, so important for achieving optimal rapport with the patient and for securing valuable diagnostic data in special cases, is substantially preserved. The consistency of reproduction made possible by the use of recorded material is also maintained, since the test words are being presented as a standard, virtually indestructible and unchanging tape recording. The exploratory use of the instrument by different institutions in their diagnostic and research programs is suggested.

V. Summary

The advantages and limitations of monitored "live" and "microphone voice" testing as compared to recorded material in speech audiometry are considered. The "Language Master," an electronic device based on the principle of the playback of a tape recorder but using the magnetic tape applied to a card, can be used for speech audiometry. The instrument appears to permit the flexibility of microphone voice testing and reliability of recorded voice testing.

622 W. 168th St.

REFERENCES

1. Hirsh, I. J., and others: Development of Materials for Speech Audiometry, J. Speech & Hearing Disorders 17:321-337, 1952.

2. Bordley, J. E.: An Evaluation of the PGSR Technique in Audiometry, Laryngoscope 66:1162-1183, 1956.

3. Carhart, R.: Tests for Selection of Hearing Aids, Laryngoscope 56:780-794, 1946.

4. Silverman, R. S., and Hirsh, I. J.: Problems Related to the Use of Speech in Clinical Audiometry, Tr. Am. Otol. Soc. 213:291-306, 1956.

5. Lidén, G.: Speech Audiometry: An Experimental and Clinical Study with Swedish Language Material, Acta oto-laryng., Supp. 114, 1954, p. 19.

6. Operation of the Language Master as a Preamplifier-Equalizer, in the Language Master, Technical Bulletin 57-1, New York, McGraw-Hill Book Company, Inc., 1955.

Case Reports

Leiomyosarcoma of the Nasopharynx

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A previous report of a leiomyosarcoma of the nasopharynx cannot be found in the medical literature. Geschickter, in classifying sarcomas of the nasopharynx, listed two cases as myosarcomas.[1] One of these was a rhabdomyosarcoma, and he has illustrated this tumor. The second case, which is listed as being myosarcoma, has no further explanation.

Nonepithelial malignant tumors or malignant connective tissue tumors are exceedingly rare. Stout collected all the nasopharyngeal tumors up to 1941, and leiomyosarcoma is not mentioned.[2] The Atlas of Otolaryngic Pathology from the Armed Forces Institute of Pathology does not list this tumor.[3]

The only smooth muscle normally found in the nasopharynx is in the structure of the blood-vessel walls. Boyd feels the muscular walls of blood vessels are immune to myoma formation.[4] This is difficult to understand in that myomatous tumors have been found in areas of the body which are normally devoid of smooth muscle, except the presence of smooth muscle about the blood vessels. Stout feels that leiomyomas of the skin and subcutaneous tissues are derived from venous structures.[5] Other explanations as to the origin of this tumor would be the totipotentiality of mesenchymal tissue and the presence of aberrant smooth muscle tissue.

The diagnosis of leiomyosarcoma is dependent upon accurate histological interpretation. The nuclei are elongated and blunt-ended with increased cellular activity as shown by the presence of mitotic figures. The characteristic intertwining of the leiomyoblasts and the presence of their myofibrils are demonstrated by the use of special staining. At times it is difficult to distinguish between a leiomyosarcoma and a hemangiopericytoma. Cell type and vascularity are the criteria for differentiation. The pericyte has a spindle shape similar to the leiomyoblast, but its cytoplasm has no myofibrils. The gradation in vascularity between these tumors varies with the hemangiopericytoma having a diffuse capillary blood supply in comparison with the sparse supply in a leiomyosarcoma.

Some of the unusual locations where leiomyosarcomas have been found are the extremities, retroperitoneum, omentum, mesentery, kidney, liver, orbit, pancreas, spleen, femoral vein, and heart.

Report of a Case

The patient is a 69-year-old widow of Finnish descent. She was first seen by the EXT Department of Henry Ford Hospital on Dec. 17, 1956. Her presenting complaint was difficulty in breathing through her left nostril for one year. There was some associated stuffiness in the left ear and pain along the left side of the throat. She had some pain over the left facial region, but this did not localize to any cranial nerve distribution.

The physical examination showed the left nostril and nasopharynx to be filled with purulent material. On cleaning the nose a whitish-gray tumor was seen on the floor of the left nasal choana beneath the inferior turbinate posteriorly. This was subjected to biopsy.

Laboratory findings: Serology negative; Hgb. 12.6 gm. per 100 ml.; RBC 4,750,000/cu. mm.; WBC 6000/cu. mm.; Urinalysis negative.

Radiologically this tumor is manifest by a $3 \times 2 \times 2$ cm. soft-tissue mass obstructing the left posterior choana. It is thus apparent how the primary symptoms of nasal stuffiness and obstruc-

Submitted for publication Jan. 15, 1958.
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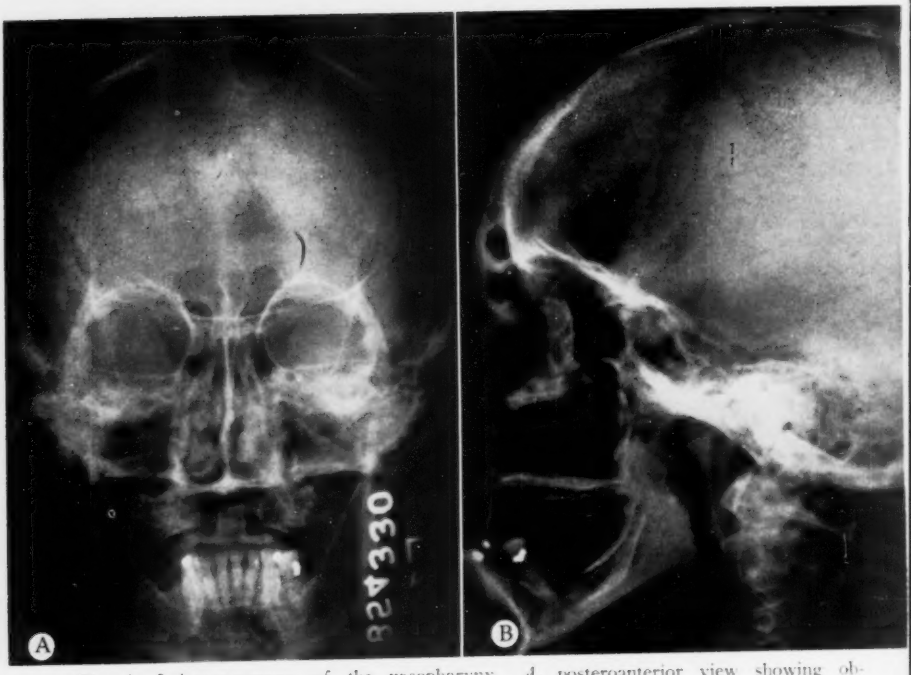

Fig. 1.—Leiomyosarcoma of the nasopharynx. *A*, posteroanterior view showing obstruction of the left inferior nasal choana. *B*, lateral view showing the tumor on the floor of the posterior nasopharynx.

tion were produced. The soft-tissue tumor has its origin from the posterior portion of the left inferior turbinate. The turbinate is not destroyed, but the medial aspect of the bone is less distinct than the opposite side. The tumor location is clearly delineated by the surrounding air. There are no characteristic roentgen manifestations for distinguishing whether the lesion is benign or malignant. A soft-tissue mass of this size in a posterior location is more frequently malignant.[6-7] The benign nasopharyngeal fibroma usually originates more superiorly and in the anterior part of the nasopharynx.[8]

Clinical data such as the sex, age, symptomatology, including cranial nerve involvement, are of help in trying to distinguish between benign and malignant nasopharyngeal tumors. The surgical biopsy is necessary for the final diagnosis.

Multiple small fragments of biopsy tissue were first interpreted as either neurofibroma or leiomyoma. The cells were spindle-shaped and intertwined; there were considerable quantities of eosinophilic-stained cytoplasm, and variation in size and shape of the nuclei. More material was requested for further study.

On Jan. 16, 1957 the lesion was excised with a surgical snare under local anesthetic. This surgical specimen was studied by Dr. J. Sieracki,* who differentiated the tumor from other mesenchymal and neurogenic tumors. The additional sections showed marked pleomorphism of the nuclei with hyperchromatism and moderate mitotic activity. A few mitoses were atypical. Specially stained sections were prepared using aldehyde fuchsin, as described in Gomori's one-step trichrome staining technique.[9] These demonstrated the red-stained myofibrils which are typically seen in a leiomyosarcoma. Later the diagnosis was confirmed by Stout.

On Jan. 28, 1957, a small area of residual tissue was seen on nasopharyngoscopic examination. This was located above the Eustachian tube cushion beneath the edge of the posterior part of the inferior turbinate. On Feb. 11, 1957, the residual tumor was electrocoagulated under general anesthetic.

On March 21, 1957, a nodule of tissue at the previous operative site was subjected to biopsy and this showed only acute inflammation.

The patient has been followed for one year with no evidence of recurrence. The patient feels well and has no symptoms.

* Senior Associate in Pathology, Henry Ford Hospital.

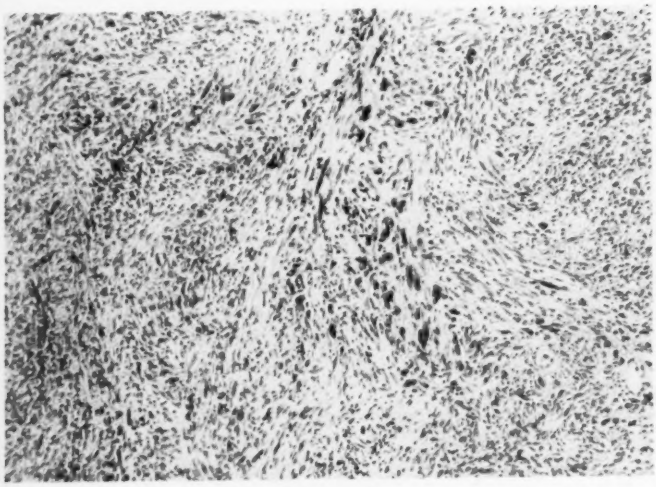

Fig. 2. — Photomicrograph of a section from the nasopharyngeal leiomyosarcoma. The section shows predominance of smooth muscle cells with an area where the cellular activity is increased and the nuclei show pleomorphism and hyperchromatism. Hematoxylin and eosin; × 150.

Summary

An original case report of a leiomyosarcoma of the nasopharynx has been presented with the radiological and histological findings.

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REFERENCES

1. Geschickter, C. F.: Tumors of the Nasal and Paranasal Cavities, Am. J. Cancer 24:637-660, 1935.

2. Stout, A. P.: Symposium on Nasopharyngeal Tumors, Laryngoscope 51:446-450, 1941.

3. Ash, J. E., and Raum, M.: Atlas of Otolaryngic Pathology, Washington, D. C., Armed Forces Institute of Pathology, 1956, pp. 189-268.

4. Boyd, W.: Textbook of Pathology, Ed. 5, Philadelphia, Lea & Febiger, 1949, p. 288.

5. Stout, A. P.: Seminar on Tumors of the Soft Tissues, Chicago, American Society of Clinical Pathologists, Oct. 19, 1951, pp. 29-31 and 33-35.

6. Samuel, E.: Clinical Radiology of the Ear, Nose and Throat, New York, Paul B. Hoeber, Inc., 1952, pp. 301-307.

7. Schinz, H. R.; Baensch, W. E.; Friedl, E., and Uehlinger, E.: Roentgen-Diagnostics, translated and edited by J. T. Case, New York, Grune & Stratton, 1952, Vol. 2: Skeleton, Pt. 2, pp. 1785-1787.

8. Pendergrass, E. P.; Schaeffer, J. P., and Hodes, P. J.: The Head and Neck in Roentgen Diagnosis, Ed. 2, Springfield, Ill., Charles C Thomas, Publisher, 1956, Vol. 1, pp. 559-561.

9. Gomori, G.: A Rapid One-Step Trichrome Stain, Am. J. Clin. Path. 20:661-664, 1950.

Use of Six-Power Glasses with Otoscope in Stapes Mobilizations

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The use of the 2× magnifying loupe in mastoid and ear surgery has become standard procedure. In the stapes mobilization operation greater magnification is desired by most surgeons, especially when working about the footplate area. The Zeiss microscope, of course, is the ultimate in this respect. For those who do not have access to this fine instrument or who desire the easier maneuverability and flexibility afforded by one's own controlled head movements, the 6× Lempert-Storz glasses with the following adaptations may be used to good advantage.

When these glasses are used with a headlight, two annoying disadvantages keep cropping up. One is the need for frequent manual adjustments of the headlight and the other is the contamination of instrument against the glasses, because of the restricted working distance when 6× magnification is used.

To overcome the first I have utilized the fixed-focus, bright, and easily adjustable light source afforded by the Welch Allyn operating otoscope, as used and described by Dr. Howard House. (The magnifying lens on the otoscope is pushed downward and is not needed.)

Submitted for publication Nov. 21, 1957.
From the University of Colorado Medical Center.

Fig. 1.—Lempert-Storz glasses with cylinders fashioned from x-ray film ready to be placed over oculars.

Fig. 2.—Lempert-Storz glasses with cylinders in place.

To avoid contamination of instrument on the glasses, I have fashioned cylinders out of x-ray film which slip over the oculars in the form of sleeves (Figs. 1 and 2). These are made to project a little longer than the oculars (about ⅛ in.). After proper sizing, each cylinder is simply stapled at each end. One of the staples can be placed so as to "catch" on the flange surrounding the lens, and thus prevent the sleeve from slipping off during surgery.

Fig. 3.—Gauze flats saturated in aqueous benzalkonium (Zephiran) wrapped around glasses for sterilization.

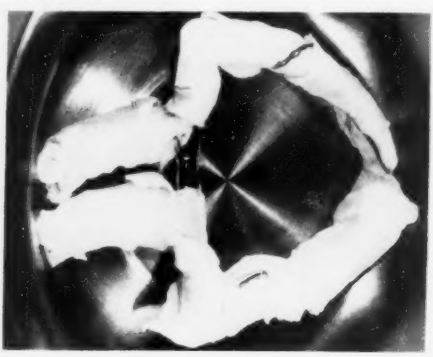


Fig. 4.—Welch Allyn operating otoscope (without its magnifying lens) is used with Lempert-Storz glasses.

To effectively sterilize the glasses and their frame I wrap ordinary gauze flats saturated with aqueous benzalkonium (Zephiran) around the cylinders and temples. This I do prior to scrubbing and I place them thus wrapped in a large sterile pan (Fig. 3). They are thus left for at least 30 minutes. The cylinders, of course, also protect the lens systems against possible damage by the sterilizing agent.

The ordinary loupe with headlight is used for the preliminaries prior to actual mobilization. The benzalkonium-treated gauze flats are then removed from the glasses by the operator himself, after which he may put them on and adjust them without fear of contamination.

The otoscope head is also sterilized by wrapping benzalkonium-saturated gauze flats around it.

It should be pointed out that monocular vision is the rule when these glasses are used in such a confined field as through an ear speculum (Fig. 4). Fortunately the otolaryngologist who has perfected himself in this monocular discipline as in bronchoscopy, otoscopy, etc., need not feel frustrated by this lack of stereoscopic vision.

227—16th St.

REFERENCE

House, H. P.: Personal Experiences with Stapes Mobilization, A. M. A. Arch. Otolaryng. 65:235 (March) 1957.

A Rongeur for Removing the Posterior Bony Canal Wall

RECTOR T. DAVOL, M.D., Greenwich, Conn.

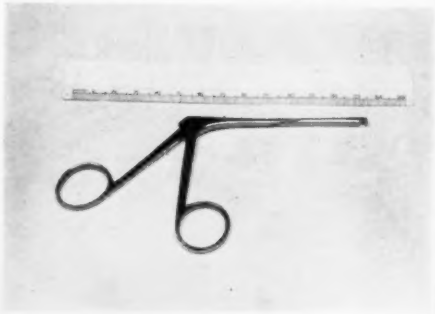
In performing the operation for mobilization of the stapes, it is often necessary to remove a portion of the bony posterior canal wall that overhangs the incus and stapes. To facilitate the removal of this bone, the instrument shown here was devised. The instrument has a thin lip that fits under the overhanging edge of the posterior canal and a cutting edge which bites out the bones between the two blades. (Fig. 2.)

This instrument was designed by me and manufactured by D. Mueller & Co., Chicago.

30 Milbank Ave.

Submitted for publication Jan. 10, 1958.

Fig. 1.—Instrument in profile.



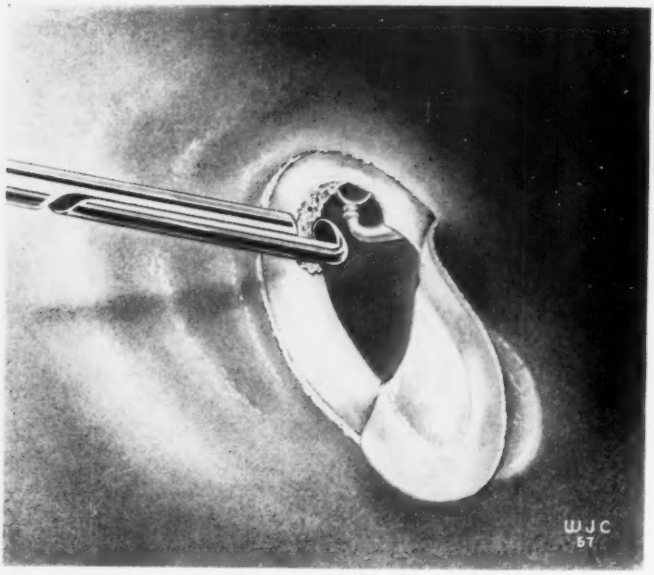


Fig. 2.—Method of using the instrument.

Progress in Otolaryngology

The Paranasal Sinuses

Summaries of the Bibliographic Material Available for 1955-1956

SAMUEL SALINGER, M.D., Palm Springs, Calif.

Liss [1] studied the histology of the olfactory bulb and extracerebral part of the tract in a number of postmortem specimens from persons ranging in age from 18 months to 80 years, by means of a silver-carbonate stain. He found four distinctly outlined layers: fila olfactoria, glomeruli, ganglion cells, and olfactory tract fibers. Seven different types of neurons were described in the bulb and three in the tract. Structures not previously described were demonstrated. These are the synaptic structures in the glomeruli, minute neurons in the ganglionic layer, and bipolar ganglion cells in the olfactory tract.

Degenerative changes in the neurons were not found in the older specimens, although an increase of the astroglia and corpora amylacea commonly seen in the senile brain were present.

Liss,[2] again employing the silver-carbonate staining technique of del Rio Hortega as modified by Sibarenberg and the author, reports further observations in a number of postmortem specimens of the human olfactory bulb. He described five types of astrocytes; periglomerular, elements with short radiating processes, others with basket-like processes, some with delicate parallel processes, and large cells with corkscrew-like processes. In the perivascular area he found six elements: astrocytes, oligodendroglia, perivascular glia of undetermined type, "transitional cells," pericytes, and nerve plexuses.

These are illustrated in several reproductions of the slides.

Histologic studies of the nerve apparatus of the mucous membrane frontal sinus in the cat were made by Shapiro.[3] These show the intricate ramifications of the end bundles of sensory nerves in the mucous membrane of the frontal sinus. Sections were stained with methylene blue.

Funaro and Leonardi [4] found a definite correlation between mental and psychiatric deficiencies and the development of the frontobasal osseous structure. Their findings are based on a study of 33 patients varying in age from 4 to 15, whose I. Q. ranged between 32 and 77. X-ray studies revealed morphologic changes in the frontobasal area consisting of agenesis of the frontal sinuses, metopism, and abnormal thickening and elongation of the internal frontal crest. The authors assume that some unknown endogenous toxin must have developed during the third fetal month which affected the development of the membranous bone as well as the frontal lobes of the brain. There are a number of references to the literature bearing on the subject, all of them proposing various theories as to etiology, but none of them very conclusive.

Toni and Trombetta [5] made a number of measurements on 500 skulls with refer-

Submitted for publication Feb. 8, 1958.

The material abstracted herein represents all of the listings relating to the sinuses in the 1956 "Current List of Medical Literature" issued monthly by the National Library of Medicine.

Dr. James Hara made the translations from the Japanese; Dr. George Simko from the Hungarian; Mrs. Albert Vertchamp from the Russian, and Mrs. H. H. Ranes from the Polish and other Slavic languages.

ence to the position and size of the supraorbital foramina. They took the distances from the foramen to the nasion, to the glabella and to the alveolus. In the first two, the minimum was 17 mm. and the maximum 32 mm. In the last-mentioned the figures were 58 minimum and 80 maximum. The diameter of the foramen varied from 1 mm. to 13 mm. The distances appeared to be slightly less on the left than on the right side.

Toni and Sanesi [6] made similar measurements relating to the infraorbital foramen on the same group of skulls. The distance from the foramen to the inferior margin of the orbit varied from 2 to 12 mm., the average being 7 mm. The distance from the foramen to the alveolar border varied from 24 to 41 mm., with an average of 32.6 mm. From the foramen to the nasion they found the average to be 45 mm. It was also noted that the foramen was in line with the second premolar, although frequently with the first premolar.

Radoïévitch and Joyanovitch [7] made some interesting observations concerning the vidian canal after a study of 700 skulls. The two canals are in the horizontal plane but are directed inward from behind forward so that if projected anteriorly the two would meet in the midline within the nasal cavity. In general, their observations indicate that the relationship of the vidian canal to the sphenoid sinus depends on the degree of pneumatization the latter has attained. For instance, in children the canal is separated from the sinus by thick bone. On the other hand, in extensively pneumatized sphenoids the canals are in close proximity to the sinus cavity and may even traverse it. At times a dehiscence in the thin intervening bone will expose the nerve. In cases where the pneumatization extends into the greater wing of the sphenoid or the pterygoid plate, the vidian canal may be completely enclosed by the sinus prolongations. These and other peculiarities are illustrated in the article.

The authors claim that the anatomical conditions described could well account for the Sluder syndrome or the vidian nerve syndrome as termed by some.

Riesenfeld [8] studied 8836 skulls in the American Museum of Natural History, representing various racial groups, from the point of view of the incidence of multiple foramina. The infraorbital, mental, and ethmoidal foramina were found to be multiple in a higher percentage of Mongoloids than in European whites. The average number of infraorbital foramina was as high as 1.25 among the Indians of the Northwest. The maximum frequency among them was 33.12%, whereas in European whites the average was 15.34%. Other items studied were asymmetry of the foramina and differences in numbers between the two sides.

Radoïévitch and Joyanovitch [9] comment on the scarcity of references to the lateral or external wall of the orbit in relation to the sinuses. In a study of 600 skulls they found that the maxillary sinus invades the external orbital wall in 10% to 12% of the cases. This comes about by extension of the cavity into orbital apophysis of the malar bone. In 1% of all the cases the pneumatization extended along the anterior-inferior aspect of the external orbital wall as far back as the inferior orbital fissure.

The frontal, ethmoid, and sphenoid sinuses have been observed extending over the roof of the orbit posteriorly and externally, invading the greater wing of the sphenoid. Thus the sphenoidal fissure may be completely surrounded by pneumatized bone communicating with these sinuses and explaining involvement of the various structures which traverse it. Pneumatization of the greater wing of the sphenoid by an expanding sphenoid sinus may give rise to the "orbital apex and sphenoid fissure syndrome" mentioned by several authors.

A study of 530 skulls, male and female, white and Negro, by Ray [10] reveals variations in the configuration of the superior orbital fissure. "The greatest divergence shown between any groups, as to configura-

tion and closure, is found among Negro males and white females."

Narrow pointed configurations were most commonly found in white females, whereas widened configurations were seen most often in Negro males. A number of illustrations show the variety of shapes designated as "point, square, round, oval, cul-de-sac, and wide and blunt."

Schimizzi[11] states that agenesis of the frontal sinus has been reported as occurring unilaterally in 5% to 7% of all cases, and 7% bilaterally. However, in such cases where the patient complains of persisting headaches, one must consider the possibility of the apparent agenesis being really an obliteration of the sinus cavity by newly formed spongy bone, the result of an inflammatory process, particularly during the adolescent period. The author cites Preysing (1911) and Skillern (1936) who called attention to this process. A pathologically obliterated sinus can be differentiated from a true agenesis by the fact that the x-ray pictures will demonstrate the outlines of the dark sinus especially in the profile projection.

The symptoms in these cases can be relieved by removing the newly formed spongy bone, allowing the space to be obliterated by scar tissue. The x-rays of several cases are shown.

Di Blasi[12] had a case of complete palatopharyngeal atresia of syphilitic origin in a 27-year-old patient. He was interested to find that the complete occlusion of nasal respiration had in no way affected the development of the sinuses, which were of normal size. He quotes several authors who made similar observations, but at the same time cites others who, in animal experiments, had found definite changes in the mucosa and in the development of the sinuses.

Stoksted[13] continues his studies relating to the physiology of nasal respiration with another contribution dealing with the determination of nasal permeability. This was accomplished through anterior rhinometry, measuring the flow in each naris separately and computing the total on the basis of several factors, namely, mean pressure, flow time, lumen, respiratory rate, and minute volume. "The permeability was calculated as the resistance of the nasal cavities during respiration, and the observed values varied between 14.8 and 45.2 mm. H_2O per second."

A graph showing distribution curve with the percental distribution of a normal series in the ordinate and the resistance during respiration on the abscissa gave absolute values of from 10 to 50 mm. H_2O per second and logarithmic values from 1.00 to 1.70. "The mean value was computed on the basis of the logarithmic values and amounted to 25.5 mm. H_2O per second, the standard deviation being 31.3 per cent."

The clinical significance of these determinations, according to the author, lies in their practical application in cases where surgery is contemplated either to enlarge or reduce the capacity of the nasal cavities. By the method described in which the velocity and duration of air flow as well as the minute volume and frequency of respiration are determined in each nasal cavity, one can calculate the total permeability in free respiration. The formulas given are not too complicated.

Ingelstedt,[14] in a detailed monograph, describes his procedure for determining the behavior of the respiratory tract with respect to the conditioning of the air currents. He points out the deficiencies of previous investigations in this field, most of which resulted in errors due to determinations based on discontinuous samples. The author's method was based on a plan of continuous recording of temperature and moisture content of air by means of apparatus at the nasal atrium, and one that was located just below the glottis. The latter was accomplished by introducing a cannula via a trocar through the cricothyroid membrane. This cannula carried a thermoelectric micropsychrometer and thermo elements whereby the temperature and moisture content of the air currents

could be graphically recorded. At the same time a pneumographic apparatus was affixed to record the respiratory excursions.

Numerous illustrations reveal the construction of these different apparatuses with pictures showing them in place. Also the graphs depicting the changes during various periods of the respiratory cycle.

Arrangements were made whereby the subject could be rapidly transported from room temperature to a cold room for comparative studies.

Very briefly summarized, the results of the experiments were as follows:

Minimum inspiratory temperature had a mean of 30.5 C. The maximum temperature of air expired had a mean of 36.2 C. The corresponding mean values for relative humidity were 90% during inspiration and 99% during expiration. Comparing the mean 36.4 C of the expired air at the subglottic level with the 33.2 C average at the nostril shows a cooling of the air by a mean of 3.2 C during its passage through the upper airways. On exposure to the cold air (−4 to 9 C) there was a lowering of the readings by 1.4 C, which, however, became less marked after 10-12 minutes, so that the readings were only 0.6 degree lower than at room temperature. Immersion of the feet in cold water had no influence on temperature or humidity of air in the subglottic space.

This contribution is a very valuable one, because of the painstaking manner in which the experiments were conducted, and should help to clarify an important aspect of respiratory physiology.

Hesse [15] claims that not enough attention is paid to the determination of the olfactory sense in cases where frontal or ethmoid surgery is contemplated. It is important that this sense be evaluated, since a loss of olfactory sense may be very disturbing to certain persons. He mentions particularly the Zwardemacher apparatus as one that is most reliable. An analysis of a number of cases that underwent surgery of the frontal sinuses yielded the following observations: In 13 Jansen-Ritter operations there was no postoperative impairment of the sense of smell. However, in six of the cases a preoperative examination showed that the patients had a subnormal sense of smell. In one case, after removal of a mucocele the sensation was improved. In 22 Kuhnt-Taftas operations, there was 1 in which the olfactory sense was lost.

Of particular interest were the results in operations where mucosal flaps from the upper septum and lateral nasal wall were elevated for lining the new channel. In these cases the loss of the olfactory sense was more frequently encountered. Anosmia and hyposmia were very common in malignant cases and also in slowly growing tumors causing pressure.

Since olfactory acuity is a potent factor in the degree of appetite and the enjoyment of food, a study of this sense was made by Guild [16] in five patients of normal build and five obese patients. He used the method described by Elsberg where "variable but measureable volumes of odoriferous air are injected into the subject's nasal passages during a momentary cessation of breathing." Acuity was found to be greatest before and least after satisfying meals. Obese individuals were found to be less acute than normal persons. When *d*-amphetamine sulfate was given 75 minutes before meals, the customary increase in acuity was no longer present.

Research by Ancetti [17] in cell content of thymic and ribonucleic acids yields some interesting data. He shows how the distribution of these elements in the various layers of the mucosa is altered in various pathologic states. Normally they are found in greater concentration in the deeper layers, the degree diminishing as one proceeds toward the superficial layers. For instance, in inflammatory conditions, ribonucleic acid is less uniformly distributed, with a tendency toward greater concentration in the superficial layers. In allergic states the acid is less abundant where usually it is best represented and may be more concentrated

in the pyknotic cells of the superficial layers. Other changes are described in nasal polypi, benign and malignant tumors.

The author thus concludes that a histochemical analysis of the tissues can yield significant data bearing on their functional activity and thus contribute to the diagnostic information.

Berendt and Nungester [18] conducted a number of experiments to determine the effect of nasal secretions on the antibacterial properties of human serum. It was found that both normal and infected sinus secretion had an inhibitory effect on complement and β-lysin. This was due mostly to inactivating the third and fourth components of the serum. This study confirms reports of anticomplementary action of hog gastric mucin and would tend to prove that unphysiologic accumulations of respiratory mucus may have a deleterious effect on the host.

Dieckmann [19] discusses the clinical significance of the so-called perisinusitis. It is a condition in which the intracranial structures adjacent to a chronically inflamed sinus become infected, giving rise to persistent localized headaches and symptoms of circumscribed meningitis. In this connection he finds that the overextended axial projection for x-rays of the frontal sinus is of inestimable value in delineating the floor of the sinus and its posterior wall. This maneuver has proved successful in showing thickening of the bone, hyperostosis, and other pathologic processes. He describes one case in detail and shows a couple of interesting x-ray pictures.

Stevenson [20] describes the gross appearance of sinus wash under various conditions as a means of determining the presence or absence of infection. As long as the mucous glands are functioning, purulent material will be caught up into clumps which thin out and become clearer as the infection subsides. The appearance of pure purulent material which clouds the irrigating fluid and sinks to the bottom of the pan may indicate a far-advanced irreversible status of the lining mucosa.

Manzanete [21] discusses the role of the various bacteria found in the nasal cavities in relation to the theory of focal infection. It is his contention that one must take into account the so-called "friendly" bacteria which are normally indigenous to the tissues and serve in various ways to combat pathogenic invaders by interposing such products as will interfere with the metabolism of these invaders. At times these indigenous bacteria get out of hand, setting up a tissue reaction which may take the form of an allergosis and be followed by the development of foci in other parts of the body. The author believes that it is most important to obtain cultures of these bacteria by way of tissue extracts for the preparation of a "histobacterial vaccine" according to Calderin. Most of the article is taken up with a discussion of the theoretical concepts of the relationship between the human host and these various types of bacteria.

Anderson and Rubin [22] present a long list of nasal, pharyngeal, and lower respiratory tract symptoms due to dryness and viscosity of secretions. Following this is a list of the etiologic agents and their mechanism. Cytologic study is a valuable aid in the diagnosis. Hansel's stain is used but often requires several applications of alcohol to remove the excess methylene blue. One finds a "large amount of homogeneous mucus containing a few cellular elements: however, small accumulations of leukocytes and/or eosinophiles may be found in varying proportions in certain areas, and it is not unusual to see a surprising number of nonlobulated leukocytes."

For therapy they advise steam-kettle inhalations, mucolytic agents such as Alevaire, saturated solution of KI., hydergine as an adrenergic blocking agent, prostigmine bromide 15 grains, Proetz's alcohol glycerine spray, and iodides.

Albernaz and DaSilva [23] discuss the various projections that have been employed in the diagnosis of ethmosphenoid disease,

pointing out the inadequacies of most of them. Since the ethmoid labyrinth or lateral masses average, according to Schaeffer, 14 mm. in width, 27 mm. in height, and 30 mm. in depth, it is important to try to photograph them in their longest dimension. This involves a technique that will demonstrate the cellular pattern as if laid out in the flat, without distortion in the horizontal plane. The authors have employed a mento-vertex position in which the head is hyperextended, the occiput resting on the cassette and the shoulders elevated. The central ray is shown entering below the hyoid at an angle of about 60 degrees from the horizontal and emerging through the frontal region. Since the aperture of the cone is only 30 cm., it is important that the head be accurately positioned in the midline and the beam directed exactly in the center. The illustrations demonstrate clearly the entire ethmoid labyrinth and the sphenoids so that there is no overlapping or distortion.

Anspach[24] discusses the various techniques for the localization of foreign bodies in the upper jaw, displaced tooth roots or broken-off injection needles. The relationship of the x-ray tube to the foreign body, the direction of the principal ray, and the distance of the foreign body from the x-ray film, are factors which can make for clarity or cause distortion. Shooting through a fixed or recognizable point, such as a prominent tooth, often serves as a landmark for locating the foreign body. In some cases needles may be inserted to serve the same purpose.

These various items are all illustrated by diagrams.

Meuschke[25] found that roentgenologic examination of the sinuses in a series of 372 patients yielded sufficient data to establish a diagnosis that agreed with the rhinologist's findings in the vast majority of cases. The histories of these cases revealed the fact that in 50% the chest or abdomen had been examined roentgenologically during the preceding year without the sinuses being investigated. This brings in focus the importance of routinely examining the sinuses in all cases where the thoraco-abdominal areas are being x-rayed. The author cites three typical cases in which a sinus infection was disclosed as an etiologic factor in disorders of other organs.

Pijade and Novak[26] point out the advantages of planography over the conventional x-rays for the diagnosis and delineation of tumors, cysts, etc. Fluid levels are sharply defined, the size and extent of osteomata clearly demarcated, and bony destruction due to malignancy more readily delineated than in routine x-rays. As has been pointed out before, stratum radiography eliminates the over- and underlying structures whose shadows so often confuse the diagnosis. Several cases are cited and head positions shown.

Lyons and Denny[27] go into great detail describing the various projections that may be used in radiography of the sinuses. They list some 15 projections, giving the names of the authors, the sinuses to be shown, the B_1-film angle, tube angle, centering, and other qualifying data. The article is replete with illustrations showing the various head positions, relationship to tube, and the resulting pictures.

D'Ajutolo[28] discusses displacement therapy and his experience with this modality since 1945. Particular attention is given to its value in diagnosis when employing contrast mediums. Iodized oils were used in 197 out of 201 cases, either in the original 40% dilution or in the 20%. In four patients who were sensitive to iodine, he used Thorotrast. Contraindications to this procedure includes cases of recurring epistaxis, acute inflammatory processes, idiosyncracy to iodine, or obstructions of such a nature as to impede the flow of the solution into the sinus openings. In some cases it is more feasible to introduce the solution by direct catheterization. The author describes the technique of the procedure in some detail. Failure may be the result of a variety of conditions, such as hypogenesis of a sinus, inadequate con-

tracture of the palate during the maneuver, and persistent swelling of the mucosa. A great number of illustrations are shown, which include x-ray pictures of cases and drawings showing head position, etc.

Petersen [29] shows how in some x-ray pictures one of the roots of a molar seem to project into the antrum. This is an illusion due to the degree of inclination of the rays. The most accurate x-rays showing the true relationship are obtained with the lowest practicable inclination of the rays, which should be as nearly as possible perpendicular to the long axis of the tooth. These points are well brought out in the illustrations.

Bouchet and Dulac [30] present what they consider the ideal formula for x-rays of the ethmoid cells in the Rhese position. If "S" represents the angle of incidence of the ray with the median sagittal plane, and "V" represents the angle of incidence of the ray with the nasion-binaural plane, the angles preferred, reckoning from behind forward, should be S = 50 g and V = 30 g.

Bäder et al.[31] find that planography done in the horizontal plane through the skull is very useful in outlining lesions of the base, the mastoid and petrous areas, and the sinuses. The pictures are taken with the patient lying on his back, shoulders supported and head extended so that the line from the auditory meatus to the zygoma is horizontal and parallel to the film below. For the sinuses the pictures are taken at depths of 15, 16, and 17 cm. Several cases are shown outlining infiltrating and expanding lesions of the sinuses and adjacent areas.

Lanzendorfer [32] describes a test whereby one may differentiate the pain of frontal sinus infection and true supraorbital neuralgia. A pad of cotton moderately saturated with ether is placed over the forehead, the patient keeping the eyes tightly closed. If the pain disappears, it indicates that the sinus is at fault. If it persists or is aggravated, it is due to a neuralgia. He explains this phenomenon on the basis that the cold reduces the hyperemia present in the sinuses and surrounding area, thus affording relief. On the other hand, the sensitive nerve in a neuralgia reacts to the cold and the pain is increased. The author claims that he has found this test most reliable in a large number of patients.

Complications: Intracranial, Orbital, Pulmonary, Osteomyelitic

Hohlbrugger [33] lists the points on which a diagnosis of nonsuppurative intracranial complications may be made. These cases usually follow an otitic or rhinogenic infection, presenting all the symptoms of meningitis or brain abscess. Stress is laid on the blood findings, which may reveal leukocytosis but without a shift to the left. Also the general good condition of the patient belies the existence of infection. The spinal fluid will show an increased cell count with positive Pandy and Nonne, but is free from bacteria. These cases showing typical meningeal symptoms and focal signs of encephalitis may be relieved by dehydrating measures plus antihistaminics and belladonna extracts. Two cases following sinus infections are cited.

Kaplan [34] reports three cases of rhinorrhea that were treated by exposure through a transorbital ethmoidectomy. The floor of the frontal sinus and entire ethmoid labyrinth were removed. A view of the inner table of the frontal, roof of the ethmoid, interior of the sphenoid, and the ethmosphenoidal recess is thus obtained. If necessary the middle turbinate may be removed to expose the septum and cribriform plate. In one case a small dark area was found in the roof of the ethmoid. This proved to be a sequestrum, which, when removed, left a draining fistula. This was closed with a bit of muscle tissue. In the second case a small meningocele was discovered at the juncture of the posterior wall of the frontal sinus and the roof of the ethmoid. This also was closed with a muscle tissue graft.

In the third case, a woman who had previously had the orbit exenterated for carcinoma (seven years ago) developed a rhinorrhea from the opposite side of the nose. X-rays were negative for carcinoma. Operation disclosed a large defect in the cribriform plate filled with granulation tissue. It was possible that this might have resulted from the extensive irradiation given after the previous surgery.

Sen Gupta[35] quotes St. Clair Thomson and Negus as having seen three cases of cerebrospinal rhinorrhea, all of which terminated fatally. The author cites a case which he observed in a 24-year-old man who complained of a watery discharge from the nose and headaches. There was no history of trauma. The headaches were relived only when the nose discharged. Examination of the ear, nose, and throat, including x-rays, revealed no abnormalities. Lumbar puncture was negative. The nasal discharge was examined: it was odorless, clear, left no stain, reduced Fehling's solution and left no sediment. An antiseptic vasoconstrictor was prescribed for inhalation three times daily. A subsequent report from the patient indicated recovery.

Edling[36] finds little roentgenologic evidence that would link sinusitis to uveitis as an etiologic factor. He investigated 155 inpatients and 30 outpatients in whom the uveitis was acute in 153 and chronic in 32. Sinusitis was demonstrated in 10.3% of the chronic cases and 8.5% of the acute. He sees no indication for routine x-rays of the sinuses in these cases unless they resist treatment or there are symptoms pointing to the sinuses as a focus.

Vogel[37] gives a brief description of the various orbital complications from sinus infections, including orbital abscess, osteomyelitis, optic neuritis, cavernous sinus thrombosis, and also the various neoplasms. He states that orbital abscess in children due to ethmoid infection may be evacuated, either through an external incision or intranasally by breaking through the middle meatus with forceps. He claims that the latter procedure is the simpler. Retrobulbar neuritis is frequently due to infection of the posterior sinuses, despite the negative findings so frequently observed. Opening these cells affords relief, which he attributes to the reduction of the hyperemia that involves the entire area.

Bonnet and Bonnet[38] describe a case of aneurysm of the internal carotid in a man of 42, producing characteristic symptoms of a lesion of the anterior fissure. There was no history of trauma but the man traced the onset to exposure to cold during a day's heavy labor. It came on during the night with severe headache lasting 48 hours, followed by slight vertigo. An attack of vomiting came on without nausea, terminating the painful crisis. A two-year period of apparent calm followed, at the end of which time double vision appeared. This was accompanied by ptosis and sensory disturbance in the area of the superior maxillary division of the trigeminus. The symptoms all pointed to a syndrome of the sphenoidal fissure. X-rays showed pressure absorption of the anterior clinoids with enlargement of the sphenoidal fissure. Also the apex of the petrous bone was eroded. Angiographs revealed an aneurysm the size of a prune located in the middle fossa. It caused a depression in the anterior face of the petrous bone and apparently was extradural.

A fatal hemorrhage due to rupture of the internal carotid artery through the sphenoid sinus is reported by Bonnet.[39] The patient, a woman of 31, had sustained a severe blow over the forehead in an automobile accident about two months previously. A radiating fracture was seen in the x-rays with fracture lines running through the floor of the anterior fossa, the frontal sinus, and cribriform plate to the opposite ethmoid. Also there was a fracture through the roof of the orbit. The optic canal and anterior clinoid process were also involved. A craniotomy was interrupted by severe hemorrhage. The external carotid was ligated. The internal carotid was not thought to be the source of the bleeding. When the patient was seen three months after the accident one eye was

found to be blind and the ocular motor nerve paralyzed. X-rays showed a deepening of the groove for the internal carotid into the anterior clinoid process. The internal carotid artery was then ligated but failed to control the bleeding, which terminated fatally. An angiogram showed a fissure in the wall of the artery causing a saccular aneurysm, which bulged into the sphenoid sinus when it ruptured.

Mazzi[40] reports a case of exophthalmos due to an extremely dilated ethmoid cell in a 14-year-old girl. The cell was readily outlined in a laminagraph, and for further study the author injected a contrast fluid deeply into the orbit at the site determined by the laminagraph. This is also shown graphically in an x-ray picture. The cell was opened up via a transorbital approach along the naso-orbital wall, and a wide communication effected between it and the rest of the ethmoid labyrinth into the nose. The exophthalmos disappeared after the operation.

Faufique and Audibert,[41] reporting two cases of optic neuritis, one associated with ocular paresis, point out the indications for sinus surgery. They agree with Canuyt and Ramadier that when an acute papillitis gives a history of a recent sinus infection or the x-ray pictures show cloudiness, one should not hesitate to explore the ethmosphenoids. In the cases they cite where the loss of vision was rapidly progressive, merely opening the antrum proved inadequate, and it was only after the ethmoids and sphenoids had been cleaned out that any improvement was noted.

Curkovic[42] refers to the cases from his personal experience in curing diseases of both paranasal cavities and tracheobronchial area simultaneously. He points out that in many cases, cough may be the only symptom.

"Cough is commonly associated with diseases not of tracheobronchial origin. In children, cough is a common symptom of diseases of the nasal accessory sinuses; this in spite of the fact that there may be neither nasal secretion nor sputum.

"The presence of signs of bronchitis should not overshadow the need for a careful examination of the upper part of the respiratory tract. The association of a sinus infection with disease in the bronchopulmonary area is extremely common. The small caliber of the trachea and bronchi of infants is responsible for extensive pulmonary changes produced by lesions which would be insignificant in the air passages of a child or an adult. A cough suggestive of bronchial irritation may not in itself be significant but it is one of the most constant symptoms of bronchial obstruction. If bronchial obstruction is suspected prompt bronchoscopic investigation and aspiration are indicated."

The communication by Boček[43] discusses the relatively frequent incidence of sinusitis, especially in children, the factors which contribute to its development, and the reliability of the various methods of examination and the criteria for diagnosing this disease. A description is given of the symptomatology of chronic occult sinusitis, the effect of the disease on the human organism, and the development and complications of sinusitis in the lower respiratory passages. Emphasis is laid on the necessity of knowing this syndrome so as to be able to apply the correct treatment. A statistical analysis of recently observed cases is added.

Siegal, Goldman, and Arnold,[44] working as a group consisting of an allergist, a rhinologist, and a bacteriologist, made a study of 109 asthmatic patients, looking for foci of infection. Eighty-two cases had a complete allergy and bacteriologic study; fifty-eight showed no evidence of clinical sensitivity. These were termed "intrinsic asthma." Twenty-four patients showing clinical sensitivity with positive skin reactions were termed "extrinsic asthma." Biopsy specimens of sinus mucosa were studied in 16 cases, cultures taken, autogenous vaccines administered, and a study made of the postoperative progress in 61 patients.

Most of the data accumulated by this study would seem to indicate that sinus

disease as a rule is not a primary cause of asthma, but rather a superimposed infection. Also it was quite evident from the results in the 61 cases that underwent sinus surgery that better results were obtained from conservative surgery than from procedures in which the sinus mucosa was removed.

Grove,[45] on the other hand, reviewing a series of 300 cases of asthma in which sinus surgery had been performed, reports 69.3% showing improvement for periods up to 23 years. Success depends upon the proper selection of cases, which means that the diagnosis of sinusitis must be confirmed. When surgery is indicated it should be radical enough to remove all the diseased tissues. An interesting observation showed that the best results were obtained in the cases of infection with associated sensitizations. Autogenous vaccines made from discharge or infected tissue removed were used postoperatively. Likewise, dust injections proved helpful.

Clerici and Vago[46] discuss osteomyelitis of the frontal bone in the light of experience gained since the advent of the antibiotics. They feel that these agents have materially influenced our procedures in the various stages of the disease, so that a new appraisal is in order. They present the histories of two cases of acute osteomyelitis, one subacute and one of chronic type. In the acute cases antibiotics are of value in limiting the process and preventing severe intracranial complications. However, they are in no sense to be considered as substitutes for surgery. Most acute cases are complicated by extradural abscess and therefore require wide exposure and drainage. They feel that the majority of cases of acute osteomyelitis reported in the literature as having been cured by antibiotics alone were really the subacute type. This condition is seldom complicated by extradural abscess, which permits one to postpone surgery until the effects of the medical therapy can be properly assessed. In these cases the ultimate surgery may be simple drainage of the sinus and possibly a subperiosteal abscess.

The chronic cases require radical exenteration beyond the apparent limits of the bone involvement, which is readily carried out through the coronal incision. Naturally, the pre- and postoperative use of antibiotics makes this procedure relatively safe. The illustrations, especially the colored ones showing the exposure, are very effective.

Nash[47] reviews his experience in nine cases of osteomyelitis of the frontal bone and comes to the conclusion that our present-day knowledge of the subject has not advanced very much in recent years. He finds that surgical procedures in the presence of acute sinus infections are the commonest cause of osteomyelitis, a contention well borne out by several of his cases. Trauma and pus under pressure account for most of the remainder.

X-ray studies are most important in the diagnosis, although occasionally they may be in error. One of the cases he cites, diagnosed as osteomyelitis, turned out to be an extensive carcinoma extending beyond the ethmoid and frontal sinuses.

Since he states that operation in an acute or fulminating "osteo" may lead to complications, and failure to operate may also do the same, it is apparent that the question as to when one should intervene is still undecided.

Ninger[48] reviews the literature on osteomyelitis and presents three cases which were cured by combined surgery and antibiotic therapy. He suggests that all of the clinics in Czechoslovakia pool their histories of cases of osteomyelitis of the frontal bone since the introduction of antibiotics, for analysis and study.

Hertle[49] cites two cases of localized bone involvement which were quite similar clinically, but proved to be two entirely different processes. One was a low-grade osteomyelitis of the frontal bone extending into the orbital process of the malar bone, the other an eosinophilic granuloma in almost the same location. The etiology of the osteomyelitis was undetermined, there being no history of trauma or sinus involvement. A possible hematologic metastasis from an

osteomyelitis of the humerus was considered but ruled out inasmuch as the preceding lesion had occurred 11 years before and had been healed for a long time. The only other possibility was an upper respiratory infection of a mild character.

Discussing the case of eosinophilic granuloma, the author comments on points of similarity between it and the Schüller-Christian and the Letterer-Siwe syndromes.

Uthgennant and Klose [50] present a lengthy analysis of the relationship between sinusitis and affections of the orbit and the lower respiratory tract. Their observations are based on a study of 528 cases of sinus disease, culled from a series of 10,000 patients seen in the clinic during a three-year period.

Included in this dissertation is a history of the development of x-ray procedures in diagnosis with illustrations showing all manner of projections and typical findings.

Physiologic considerations are entered into as bearing on the effects of various atmospheric irritants that accompany the inhaled air. Etiology, incidence, symptomatology, diagnosis, etc., are all categorically analyzed and statistics are cited. The relationship of sinus disease to oculo-orbital affections is given in detail; also the sino-bronchial syndrome as relating to bronchiectasis, asthma, pneumonia, etc.

According to the authors, 5% of all their clinic patients had sinusitis; 15% to 20% of all lower respiratory disease patients had accompanying sinusitis, and 40% to 50% of the virus and pneumococcal infections displayed definite evidences of sinus infection.

Asthma and sinusitis, according to their statistics, were associated in 20% to 50% of all cases. In 210 cases the etiologic factor was multiple in 131 and was single in 79.

The authors' conclusions are as follows:

1. Disease of the sinuses nearly always causes some disturbance of the entire respiratory system. Climatic, toxic, infectious, and allergic damage may affect the entire respiratory tract.

2. Nasobronchial reflexes and direct transmission by inhaled secretions are the pathways from upper to lower respiratory systems.

3. Bacterial sinusitis superimposed on an allergic background can cause severe and prolonged asthma. Symptomologically these factors may be difficult to differentiate.

4. Bronchial asthma is etiologically not a disease entity.

Sinusitis in Children

Kaiser-Meinhardt [51] calls attention to an increasing awareness of sinusitis in children, for which he credits American authors. He presents a long list of authors of various nationalities, summarizing their findings bearing on the association of sinus disease with other ailments. Also he compares the symptoms and findings of sinusitis in children with the incidence in adults. Subjective symptoms are less frequent in children, but objective signs such as nasal obstruction and discharge are more common. Also polypi are very rare in children as compared with adults. Sinusitis in children is being diagnosed more commonly than heretofore.

The author stresses the value of routine x-rays of the sinuses in children with bronchopulmonary and otitic infections.

Schlander and Neuberger [52] catalogue all the causes of nasal obstruction in infants and children, beginning with congenital anomalies, atresias, and neoplasms, going through the entire list, including syphilis and tuberculosis. Then they describe the various inflammatory processes, the exanthemata, adenoids, and other nasopharyngeal growths, and allergy. Practically nothing is said of therapy, the entire article being confined to a listing of every possible etiologic factor with numerous references to the literature.

Keiser [53] points out the importance of investigating the sinuses in young children where unexplained temperature and meningeal symptoms are present. Four cases of this type are presented, in which there were no local findings suggesting sinus involvement, which was discovered only after x-ray pictures were taken showing clouding of the antrums and ethmoids.

Kos[54] emphasizes the role of sinusitis as a causative agent in the production of a chronic infection of the adenoids and the nasopharynx, which leads to tubotympanic involvement. In a series of 344 consecutive adenotonsillectomies performed in the University Hospitals of the University of Iowa, he found 103 (30%) suffering from hyperplastic or purulent sinusitis. Postoperative improvement by x-ray therapy was noted in 41 cases. Twenty-one cases were allergic and failed to respond to irradiation. In 41 cases there was no postoperative improvement or no follow-up. These figures refer to the results so far as the otitis media was concerned. He concludes that "adenoidectomy should be done as soon as it is reasonably safe after the ear and/or sinus infections develop."

Van Caneghem[55] calls a chronic cough associated with chronic sinusitis in children "toux barrage." He describes it as repetitious cough, short, easy and moist, and accomplished without effort. In the beginning it is entirely tracheal in origin, due to aspiration of secretions from above, and at this period reveals no symptoms of bronchopulmonary disease. If the cause is not discovered and eliminated, the pathology will eventually extend into the lower respiratory tract with manifestations that can be readily observed. In some cases such a cough may last for years into adult life. The author points out that in 115 children brought to the E. N. T. clinic, the symptom of cough was mentioned only nine times, whereas careful interrogation brought out the fact that cough was actually present in 70 cases. Sinusitis is seldom considered because of the paucity of local symptoms and it is only by a study of the x-ray pictures and by irrigation of the sinuses that the diagnosis is established.

Maspétiol, et al.[56] report excellent results following the instillation of hydrocortisone into the antrums in children. They cite three cases in which contrast media demonstrated the remarkable reduction in the thickness of the lining membrane after one injection. They claim that the results are not so dramatic if the drug is given by mouth. General anesthesia is employed and a self-retaining catheter is left in the sinus for a few days to permit frequent irrigations.

King[57] finds that the symptoms of the common cold vary with the age of the child. In early infancy it is mostly sneezing, congestion of the nasal mucosa, and very little fever or drainage. At a later date (2 to 6 months) the throat is likely to become inflamed and there may be some hoarseness. Up to the age of 2 or 3 years there will be more fever and cough with bronchopulmonary complications. The author refers to abdominal symptoms suggesting acute appendicitis in these children, which may occur simultaneously, although most of the cases of pain, vomiting, and diarrhea may be "intestinal flu."

The treatment suggested follows the usually accepted principles of ventilation and drainage. However, it is to be noted that osteopathic manipulations are recommended even in young children in practically all cases.

Schobel[58] recommends the use of polyethylene tubing for permanent drainage and irrigation of the antrum in children. The patient is hospitalized and the irrigations carried out every three hours, followed in each instance by the instillation of an appropriate antibiotic. A photograph of a child with the tubes in place presents a very cheerful-looking lad who doesn't appear at all sick!

Petrocini and Bullio,[59] reporting five cases of osteomyelitis of the superior maxilla in infants, describe the typical symptomatology consisting of rapid onset, marked constitutional reaction, early appearance of swelling and fluctuation with formation of draining fistulae externally into the nasal cavity and orally. The etiology in their cases could not be traced to mammary infection in the mother, as has been reported by others, and a marked rhinitis was present in only one case. The predominating organism was the Staphylococcus pyogenes aureus, which proved very sensitive to penicillin and

erythromycin. All of the cases involved infants within the first three months of life.

Vogt[60] reports four cases of osteomyelitis of the superior maxilla in infants, all due to hemolytic S. aureus. In three instances the infection was transmitted from mastitis in the mother. In the fourth case the infection came from otitis media in the mother. Despite active antibiotic therapy, these patients had to be operated on for the drainage of pus pockets and removal of sequestrums.

Roy[61] reviews the important data relating to allergic nasosinusitis in children. Hereditary tendencies and a sensitive neurovegetative system seem to be the principal factors in the etiology. Diagnosis is made on the basis of frequent colds, nasal obstruction, and watery discharge. These patients seem to be dull and sluggish and do poorly in school. Superimposed infection often leads to associated bronchial cough. It is difficult to isolate one allergen as the principal irritant because in so many cases the patients react to many agents. The author cautions against the prolonged use of nose drops. Instead he recommends nasal lavages, vitamins, aerosol inhalations embodying SH_2, and change of climate.

Tumors: Malignant and Benign

Malignant Tumors.—Takashi[62] attempts to classify carcinomas of the sinuses on the basis of epithelial elements from which they arise. Out of 72 cases that were studied 41 were of the squamous cell variety. The tumors were divided into three groups: carcinoma originating from the surface epithelium and the major part of the excretory ducts, carcinoma arising from the transitional portion of the ducts and glands, and unclassified carcinoma.

In the first group the basal cells predominate and, being subject to various types of development, may reveal corresponding variations in the tumors. Carcinomas in the second group are less common and present features characteristic of salivary gland tumors. The author describes one case of clear-cell adenocarcinoma with oxyphilic granular cells, a case of cylindroma of glandular origin and an adenocarcinoma with acanthomatous areas.

The author describes in detail many of the distinguishing features in a variety of structural combinations such as anaplastic adenocarcinomas, solid or trabecular adenocarcinoma, mucous-cell adenocarcinoma, adenoid cystic carcinoma, and the others mentioned above.

A study of 72 cases of malignancy involving the nose and paranasal sinuses by Hendrick[63] brings out the fact that most of these tumors are of the squamous-cell type and not usually radiosensitive. Adequate therapy implies a combination of surgery, electrosurgery, and irradiation. Several cases are illustrated. A carcinoma of the septum is exposed by a modified lateral rhinotomy and destroyed by electrocoagulation. An extensive lesion of the superior maxilla is removed via a large facial skin flap through which the superior maxilla and orbital contents are exenterated. The raw areas are immediately covered with a split-thickness graft and the flap sutured back. If radium tubes are to be used, they are incorporated in the iodoform gauze packing. Since these cases do not as a rule metastasize, radical neck dissection was performed in only six cases. The results were very good in four of them, the two others being far advanced when first seen.

Of 64 cases involving the sinuses, 26 were seen early. In the remainder the disease was already advanced. Forty patients had irradiation therapy followed by radical surgery. Of 19 who were operated upon more than three years ago, 14 are living and free of disease.

Turnbull and Hara,[64] comparing statistics from three institutions, found a wide variation in the salvage rate (from 50% to 33.3% to 6.6%) in the matter of malignancies of the sinuses and nasal organ. This is attributed to differences in the composition of the material studied.

Analysis of the material includes the classification of the histologic findings, the symptomatology, local findings, x-ray studies, and methods of treatment. Squamous-cell carcinomas were by far the commonest type encountered. Early symptoms were not characteristic and, on the whole, no different from those arising from chronic inflammatory conditions. Definite diagnosis is therefore often late and can be confirmed only after biopsy.

The authors list the reports from various centers on the survival rates, which vary according to the types of cases listed and the therapy employed. Naturally, the results will be better in the groups termed as "operable" than in the "total series."

In discussing therapy, a combination of surgery, electrodesiccation, and irradiation is generally in vogue. The authors claim that irradiation should not precede surgery, but is of great value in the postoperative period. Regional nodes should be irradiated also.

Pfander[65] submits some observations on the results of therapy in 102 cases of malignant tumors of the nose and paranasal sinuses. Involvement of the regional nodes was seen in 16 cases. The symptoms were visible mass in the nose, 73 times; unilateral obstruction, 45; unilateral discharge, often bloody, 67; external swelling, 52; orbital symptoms, 32; oral manifestations, 18. In 65 cases there were roentgenologic evidences of bone involvement. In all but two cases which were far advanced the therapy consisted of radical surgery plus irradation. In cases where the tumor invaded the orbit they avoided exenterating the orbit as was formerly their practice, except where it could be determined that the lesion was confined to the orbit and they could be certain to remove it completely into normal tissue. Otherwise they rely on pre- and postoperative irradiation. Ligation of the external carotid was not thought necessary. In most cases they ligated the internal maxillary artery. Local injections of procaine and epinephrine were helpful. Irradiation was done with deep x-rays and intramural radium.

Of 57 cases treated between 1943 and 1950, 25 were symptom-free for more than five years.

Brun's results[66] in the treatment of 58 malignant tumors of the upper jaw showed 29% symptom-free after two years and 15% after five years. He claims that these results correspond to those experienced in other clinics, with the exception of the Curie clinic, which reported 29% to 38% five-year cures. His cases are tabulated according to types of growth, location, and extent of involvement. As is well known, the prognosis is worse when the growth extends into the pterygopalatine fossa or the ethmo-orbital area. Combined surgery and irradiation is indicated in extensive lesions, the irradiation usually following the surgery.

Surgery alone was indicated in only a few cases. Irradiation alone was indicated in highly sensitive tumors and in cases of widespread involvement where radical surgery could not possibly reach all of the growth.

Vathy[67] summarizes findings and results in 50 cases of malignant tumors of the nose and sinuses from the University Ear and Nose Clinic in Budapest. There were 31 carcinomas, 11 sarcomas, and 8 others. Localization of the growths was as follows: ethmoid 9, maxillary sinus 19, alveolar 9, and nasal cavity 13.

Histologically, most of the carcinomas were epidermoid (22 out of 31). There was no special predominating type of sarcoma, five different varieties being listed.

As for treatment, 22 received x-ray therapy, 15 surgery combined with x-rays, 12 x-rays followed at a subsequent date by surgery and x-rays, and 9 cases were inoperable. Surgery performed consisted of 7 ethmoidal resections, 12 total maxillary resections, and 7 partial maxillary resections. Cervical metastases were found in five of the carcinomas and six of the sarcoma cases. Survival beyond three years

without symptoms was noted in nine cases and beyond five years in only three.

Skolnik et al.[68] describe in detail the course of two cases of osteogenic sarcoma which developed in skull areas following irradiation therapy for neoplasms. Also they review the literature on the subject with a record of 43 cases reported.

In the first case the authors report on a man of 20 whose sarcoma developed several years after he had been subjected to a series of x-ray treatments for a post-traumatic keloid. The second case was in an 11-year-old girl who, at the age of two months, was given radium treatments for a retinoblastoma. The eye was subsequently removed, but a mass developed in the frontal area which increased in size, extending down alongside the nose. It was at first thought to be a chondrosarcoma, but at autopsy was proved to be osteogenic as well as cartilaginous. The growth involved all of the sinuses, the orbit, and cribriform area. A study of these cases as well as those previously reported would seem to indicate that the process is more likely to develop in the young following a minimum dose of 3000 r and given over a period of time rather than at one session.

Terracol and Camps[69] report two cases of cancer of the frontal sinus, in both of whom there was a history of trauma. In the one instance the trauma was directly in the supraorbital area where the tumefaction appeared later. In the other case it was a skull fracture sustained many years before. The diagnosis is difficult in these cases until the growth reaches the stage of exteriorization with deformity. At the time when the growth is still entirely endocavital there are few symptoms to suggest the necessity for intervention, unless discharge and pain are present, indicating a sinus infection.

In the first of the two cases it wasn't until the third operation for removal of diseased bone that the true diagnosis was established. A fourth operation disclosed extension into the base of the skull. In the second case the diagnosis was made after the first operation, which was a Caldwell-Luc that failed to halt the symptoms of headache and impaired vision, which were soon aggravated by exophthalmos and signs of invasion of the orbit.

Spaulding[70] reports a case of ameloblastoma of the superior maxilla in the region distal to the left upper canine for a distance of 3 to 4 cm. and down to the crest of the ridge. The translucent area with bony trabeculae showed up nicely in the x-rays. The lesion was exposed through a palatal flap by uncapping the bone. It was found to communicate with the antrum. Histologically the specimen consisted of epithelial strands and masses; these were lamellated in some areas and showed pearl formation in others.

Gordon[71] reviews a series of 55 cases of malignant tumors of the nose and sinuses and comments on the radiologic features in diagnosis. It is apparent that conclusive x-ray confirmation of malignancy cannot be expected until there are evidences of bone involvement. If such evidence is not present, the opacity within the antrum can be interpreted only through biopsy.

X-rays can be very helpful in locating the site and extent of the growth, and may prove valuable in the decision as to type of therapy to be followed out. Several examinations following therapy afford information as to the presence or absence of recurrence.

The illustrations in this paper are very illuminating.

Rainer and Burne[72] present a case of a frontoethmodal carcinoma in a man of 85. It appeared as a mass directly between the eyes, which were both displaced externally by the expanding mass. Biopsy, at first reported as a lymphosarcoma, later proved it to be an anaplastic carcinoma. Because of the patient's age and the extent of the growth it was decided not to subject him to surgery or radiotherapy. Death followed within a month of the diagnosis.

and an autopsy revealed involvement of all of the sinuses, with extension into the cranial cavity.

Sciarra and Hallberg,[73] reviewing the literature since 1940, were able to find only seven cases of primary carcinoma of the frontal sinus, and cite Breeding's report in 1940, which tallied 82 cases reported up to that date. Because in most cases the carcinoma involved other sinuses besides the frontal, it is not always possible to determine definitely that the lesion developed primarily in the frontal.

The case which they report was unquestionably a primary growth, and the diagnosis and subsequent successful outcome were due to early investigation through which the unsuspected carcinoma was discovered. The patient, a 43-year-old man, complained of severe frontal headaches for several months, loss of weight, and anorexia. Localized swelling, nasal discharge, and x-ray findings suggested osteomyelitis. Through an external incision the lesion was exposed in the form of a tumor about an inch in diameter. Frozen section proved it to be a squamous-cell epithelioma which had already perforated the posterior wall, involving the dura. The latter was left intact after the tumor had been removed, and it was treated with radium.

The postoperative defect was repaired later through several plastic operations. The patient was alive and well without any evidence of recurrence 12 years after operation.

Bartalena's case[74] was a man of 58 who had had a laryngectomy in 1951 with complete recovery. It was reported as an epithelioma Grade III. Some three years later the patient developed a number of isolated subcutaneous nodules which were not painful but seemed to gradually increase in size. At the same time several nasal hemorrhages called attention to a fungating mass in the ethmoid region. Biopsy specimens from the nose and from the subcutaneous nodules revealed similar histologic structure, which was diagnosed as basocellular epithelioma Grade IV. Despite intensive irradiation, the patient succumbed.

Discussing the possible relationship between the larynx condition and the processes which appeared several years later, the author was inclined to conclude that the ethmoid neoplasm was an independent lesion, the skin metastases being related to it rather than to the preceding larynx carcinoma.

Fojtík[75] obtained a very good result in an extensive case of carcinoma of the antrum in a 35-year-old patient. A radical procedure was undertaken, including resection of the maxilla, exenteration of the orbit, and cleaning out of all the sinuses. The dura, which was exposed and apparently involved, was excised and replaced by a fascia lata graft. The area was subsequently irradiated. The author feels that this case demonstrates the fallacy of labeling some cases as inoperable.

Ratko[76] emphasizes the importance of careful attention to the details of examination in cases suspected of being malignant. He mentions the early symptoms of hyperesthesia of the face, fullness, nasal obstruction, and toothache, followed later by pains, epistaxis, and deformity. The diagnostic procedures of x-rays, exploratory puncture, and cytologic studies are briefly discussed. The author expresses particular interest in "inverting papilloma" otherwise termed "papilloma durum," "nasal papilloma" and "cylindrical-cell carcinoma." He describes the histologic picture as an invagination or "inverting" of the covering epithelium of otherwise polypoid tissue. "This inverted epithelium becomes gradually more and more prominent until there is almost complete replacement of the loose stroma by masses, islands and trabeculae of epithelium." Usually the basement membrane is intact; there is little evidence of anaplasia and only a few mitotic figures. The appearance resembles that of "carcinoma in situ" of other locations.

Although the lesion is mostly benign histologically, its clinical course is malignant and it should be so treated.

Harman et al.[77] offer a very interesting analysis of 16 cases of malignant lymphoma of the nose and throat, giving case histories, summaries, and showing typical histologic pictures. Because of some confusion in the nomenclature, the authors set out by defining malignant lymphoma as a "tumor involving one or more cell types of the reticulo-endothelial system which if untreated will lead to the death of the patient." The cells most frequently involved are the white blood cells and the reticulum cells. Of the nonleukemic types there are four commoner varieties, namely, follicular lymphoma, lymphosarcoma, reticulum-cell sarcoma, and Hodgkin's disease. The histologic characteristics of each are described. The clinical course is quite similar in all but Hodgkin's disease, which is accompanied by febrile reaction and pruritis. Tables showing the location of these growths and the clinical pictures of each furnish much valuable information. The authors quote Maximow and Bloom as having designated the multipotential primitive mesenchymal cell as the common ancestor of the various cells of the reticulo-endothelial system.

A follow-up of the 16 cases showed 5 still alive from two to six years after diagnosis.

Therapy consists of high-voltage radiotherapy, the tumors being usually very radiosensitive. Surgery plays a minor role. When bone is involved, the prognosis becomes grave, and this is especially true of growths originating in the nasopharynx.

Metastases from carcinoma of the antrum are uncommon. The case reported by Marquès et al.[78] was in a woman of 58 whose malignancy involved the lower portion of the maxillary sinus and was shown to be an atypical epithelioma on biopsy. It was treated by deep x-ray therapy for a total dosage of 12,000 r in 26 sessions. The mass disappeared, but a few months later a metastatic nodule was found under the skin on the arm and another on the face. These were excised and proved to be malignancies of the same type as the original. A month or so later, some new nodules were observed on the face and the thorax. The final outcome of the case is not mentioned, although it is not difficult to imagine.

Christiansen's case[79] was in a man of 54, presenting a mass in the maxillary ridge from the premolar area posteriorly, ending in a huge prominence of the tuberosity. When exposed through a flap incision it proved to be a firm fibrotic mass which filled the antrum and extended to the orbital floor. Although it was shelled out completely, it was noted that several small bands of fibrous tissue seemed to perforate the floor of the orbit at the point of attachment of the growth.

Histologically it was considered a malignant growth developing from salivary gland tissue. It consisted of bands of small hyperchromatic cells with marked tendency to clear cells. Mucin was found throughout the tissue.

Gros et al.[80] found a very unusual aftermath to a Thorotrast injection into the antrum. The patient was a 36-year-old man who, while in the army about 15 years ago, had some contrast medium injected into the antrum. Fifteen years later he began having pains in the cheek, nasal discharge, and swelling. X-rays revealed a dark antrum with destruction of the orbital floor and appearance of a foreign body or residuum.

Histologic examination of the exenterated tissues showed a stratified spinocellular epithelioma with lobulated trabecular conformation, considerable cornification, and numerous mitoses. No trace of the original Lipiodol was found, but accumulations of a colloid material with some crystals suggested a residuum of the oil. The authors believe they could distinguish some traces of alpha radioactivity, which was attrib-

uted to the decomposition of the Thorotrast.

Waltner and Fetton [81] found that numbness of the cheek was an early sign of malignancy of the antrum in four cases. Three of them failed to show any evidence of bone involvement on x-ray examination. Therefore, when this symptom is elicited, even though the x-rays are negative, it is proper that the sinus be explored.

Lawson [82] reports a case of chondrosarcoma which had been followed for 15 years. Originally it was diagnosed as a chondroma which was removed from the nasal septum. Subsequently the growth reappeared and a second operation proved it to have undergone malignant degeneration. Several courses of deep x-ray therapy were given over a period of five years, but the growth continued to expand and, at the last operation, was shown to have involved the antrum and other sinuses. Because of the wide extension into the orbits and the base of the skull further attempts at extirpation were not considered feasible. Autopsy showed extension into both orbits and the base of the skull.

Pellegrini [83] in a very extensive monograph discusses all the aspects of various neoplasms of the ethmoid. Included are various benign growths of connective tissue and epithelial origin as well as the different types of malignancy. He claims that the ethmoid is the most frequent site of tumors of all the sinuses and nasal organ because of its embryologic and postnasal evolution as well as its susceptibility to infection and chronic inflammation, which is responsible for epithelial metaplasia. It is interesting to note that in his opinion more than 75% of ethmoid tumors have malignant characteristics.

Tumors in this region rarely offer any early symptoms, suggesting their true nature because of the indeterminate function of this sinus. The only early sign which the author has found to be quite reliable when the tumor is still in the endosinal stage is an irritation and later anesthesia of the skin and mucous membrane supplied by the nasal and sphenopalatine nerves (Pietrantoni's sign). Later, of course, the expansion of the growth will be manifested by its encroachment on the adjacent areas. This leads to deformity, orbital and ocular disturbances, and nasal obstruction. X-ray pictures are always of value, and stress is laid on the added information obtained from planographs.

The treatment suggested in the malignant cases is as follows: Preoperative x-ray therapy: 2000 r within two to three weeks; electrosurgical excision through an external approach. The bulb will have to be sacrificed when the orbital capsule is encroached on. Postoperative x-ray therapy is indicated as well as intracavity irradiation.

The article is well illustrated with numerous pictures of patients pre- and postoperative, x-rays and diagrams, as well as histologic sections.

Two of the three cases reported by Takashi [84] were unusual neoplasms apparently arising from or involving the ethmoid sinus. The first case which ended fatally was a tumor of neurogenic origin presenting symptoms of a basal tumor involving the second to the seventh cranial nerves. At autopsy a tumor the size of a pigeon's egg was found in the middle fossa, embracing the radicles of the trigeminal, facial, and acoustic nerves. Another growth in the petrosa had eroded both anterior and posterior clinoids and extended into the posterior ethmoids and sphenoid. Sections showed rosette formations suggesting neuroepithelioma or retinoblastoma. Other sections were of the basaloma type which brought up the possibility of its origin being in the nasopharynx or the sinuses.

The second case presented symptoms of nasal hemorrhage and bleeding. Visual disturbances and x-rays pointed to a growth in the ethmosphenoid area. Biopsies revealed tissue mostly of the melanotic type.

A case of necrotizing infection of the face or malignant granuloma reported by Ye, Robinson, and Hamilton [85] lasted only

four months from the time the patient was admitted to the clinic. Following a minor bruise to the cheek three months previously, the patient developed an ulcer in the buccal sulcus. This lesion extended rapidly throughout the cheek and face and failed to respond to the various therapeutic measures employed. Despite the proved sensitivity of the organisms to chloramphenicol, administration of this agent, along with penicillin, erythromycin, cortisone, and streptomycin, proved of no avail. Repeated cultures revealed microaerophilic gamma Streptococcus, Staphylococcus both hemolytic and nonhemolytic, Candida albicans and paracolon bacilli. A number of photographs depict the rapid extension of the disease and the typical malignant widespread destruction of tissue.

Paterson[56] had the rare opportunity of observing six cases of malignant granuloma in a period of two years, and records in detail the development and course of the process. Three of the cases succumbed in a short time, while the others are apparently in abeyance, at least for the time being. In one case, numerous nodules were found on the arms, back, and buttocks, which on biopsy excluded the possibility of metastasis, revealing only thickened epidermis with inflammatory reaction in the corium. In two cases severe keratitis was present. In two of the three fatal cases, autopsy revealed evidence of disease of the arterioles.

While the true etiology of this condition is not known, the observations of this author as well as others quoted would seem to point to an angiitis incited in susceptible individuals by some unknown pathogen. Cortisone and ACTH had but little temporary effect in halting the process. The administration of Aureomycin and Chloromycetin appeared to yield some benefit, at least in controlling the acute exacerbations and reducing the secondary bacterial gangrene into a dry form of necrosis. Radiotherapy in the form of deep x-rays was more effective than radium.

Benign Tumors.—A case of giant-cell tumor in a woman of 42 is reported by Melinkov.[57] There was a history of trauma to the left cheek five months previously, causing a painful swelling, hemorrhage, and a hematoma, all of which gradually absorbed. However, a swelling developed just below the eye, of bony consistency, extending backward into the orbit. Movements of the bulb were painful. The mass appeared dense in the x-ray pictures, which led the author to believe it was either a chondroma or an osteoma. It was exposed via an external incision below the orbital margin and was easily shelled out. Histologic examination showed it to be a typical giant-cell tumor which certainly was in a very unusual location.

Prietzel's case[55] was in a woman of 70 who, some 26 years previously, had undergone an intranasal frontal sinus operation. About 20 years after the operation she developed a swelling above the eye, which was tender. X-rays showed a cloudy frontal sinus. Since the symptoms were not pressing and on account of the patient's age, the case was treated conservatively by intranasal frontal sinus irrigation with Nebacetin. Later the duct closed in, and the frontal accumulation eroded through the anterior wall of the sinus, with an external fistula. Conservative therapy through the fistula and intranasally was continued for a few months until eventually the sinus was cleaned out through an external approach, the ethmoids being exenterated at the same time to provide a wide drainage channel into the nose. Aside from some external deformity and hypesthesia of the area the result was good.

According to Meunier et al.,[59] the diagnosis of mucocele is not always as easy as it seems, since other lesions giving rise to similar symptoms may resemble the mucocele. As evidence they report several cases which were misdiagnosed. A child of 15 presented a painless swelling at the internal angle of the orbit, which was diagnosed as a mucocele but which at operation proved

to be a granulation mass arising at the superior oblique. In another case, a girl of 13 had a soft swelling in the same area since the age of 9 months. This was shown to be a dermoid cyst at operation. Another case in an adult was an empyema of the frontal sinus which had perforated the floor. The fourth case was an unusually expanded frontal sinus. The last case was an enormous mucocele which involved the frontal and ethmoids and extended down into the antrum.

The authors stress the value of planographs in the differential diagnosis.

Kassay and Kolba,[90] reporting three cases of frontoethmoid mucocele, claim that by preserving the mucosal lining the recovery period was greatly shortened and the communication with the nasal cavity maintained. Naturally this is possible only if the anatomical relationships are favorable and the mucosa not too degenerated.

Lovi[91] describes a case of mucocele causing an exophthalmos of 5 mm. with displacement of the bulb downward and outward and impaired mobility in all directions. It was successfully removed under local anesthesia. The author comments on the comparative rarity of this condition, having found only four cases in a period of four years among 15,000 patients.

According to Laszka,[92] "Mucocele of the accessory sinuses of the nose are rare. Their pathogenesis hasn't been yet finally explained although there are many theories concerning their origin. A trauma seems in many instances an essential factor induce in the appearance of a mucocele." The author describes a case of giant mucocele of the frontal sinus and the ethmoidal labyrinth with injury to the optic nerve. The sight did not improve in spite of the operation.

Illustrations show a prominent bulge at the internal angle of the orbit with marked displacement of the bulb downward and outward.

Andrew[93] had five patients with osteoma of the frontal sinus whose ages ranged from 14 to 60. In three of the cases there was a history of prior trauma. Headache or pain was present in four, swelling or deformity in all five, visual disturbances in three, and intracranial infection in two. These tumors were all large, and in every instance a frontal craniotomy through a bone flap was the avenue of approach. In one case the patient came in with an orbital abscess and a meningitis which subsided under antibiotic therapy so that after a period of five weeks it was safe to operate.

In another case the patient had a frontal lobe abscess which was successfully drained before surgery was undertaken for the removal of the tumor. Both of these patients gave a history of trauma. The complications developed at a later date following an acute upper respiratory infection.

In the case reported by Sasso and Smolcic[94] a 19-year-old man gave a history of having some trauma to the orbit and frontal region. Subsequently an exophthalmos with displacement of the bulb downward and outward was noted. X-rays disclosed an osteoma which obstructed the nasofrontal duct leading to the formation of a mucocele (30×30 mm.). The mass was removed via a Riedel operation, and it was found that the mucocele had eroded the roof of the orbit.

Perucci and Testani[95] report their observations in a series of four cases of osteoma encountered in a 10-year period. There was a history of trauma in three of the cases. The two female patients were 47 and 50 years of age, while the males were 27 and 35. The authors feel that research into the question of sex and age in relationship to these tumors might produce some interesting etiologic data.

De Villasante[96] presents a lengthy discussion on the subject of osteomas along with the history of a case with some unusual features. It had to do with an osteoma originating in the ethmoid but expanded into the frontal which had ex-

tended through the intersinus septum into the opposite frontal. At the same time the opposite sinus became infected with involvement of the antrum. Symptoms of headache, vertigo, and vomiting attributed to the osteoma were in reality due to the infection in the opposite sinuses. There was an abundant discharge, much of it foul-smelling, which the patient had been swallowing, causing gastric distress, headache, etc. Several operations were performed before the bilateral conditions were controlled.

With citations from the literature, the author at last sets forth certain principles guiding the therapy in these cases. He claims that all of them can best be handled via external frontoethmoid approach, except cases in which intracranial complications are present. Should the sinuses be infected at the same time, it may be necessary to operate in two stages.

Ceypek and Madrozkiewicz[97] depict a large frontal osteoma in two nice diagrams. It involved almost the entire frontal sinus and extended into the ethmoids and downward into the nasal bridge. Despite erosion of the posterior plate, exposure of the dura and displacement of the bulb, it was successfully removed without damage to these structures.

Kopovoi[98] reports a case of osteoma in a 21-year-old man, which was more or less centrally located invading both frontal sinuses and root of the nose. The region over the left supraorbital margin was fluctuant and yielded a bloody purulent material on aspiration. Diplococci were found on culture. Evidently it was an infected mucocele due to blocking of the nasofrontal duct. The author gives a detailed description of the surgical procedure for removal of the mass.

Osteoma of the sphenoid sinus is very rare. Leroux[99] reports a case in a woman of 57. There was a history of abundant foul greenish discharge for several months. X-rays showed a dense shadow behind the septum, high up on the anterior aspect of the sphenoid. After resection of the septum and middle turbinate it was possible to palpate the tumor with a probe, which revealed its density and firm attachment. The author states that he would attempt its removal via a transmaxillary approach.

Sensini and di Brino[100] believe they discovered a case of frontal osteoma in its very incipiency. The patient was a man of 33 whose complaint was recurring headaches, aggravated by a cold in the head. He had suffered these headaches early in life and had been examined, and a diagnosis of chronic frontal sinusitis was established with the help of x-rays. Subsequently he served in the navy on a submarine, and noticed that the headaches were always severer after submersion. Later, when examined by the authors, x-rays revealed a very small osteoma attached high up in one frontal sinus near the intersinus septum. Also he had a marked septum deviation and hypertrophied turbinates. Resection of the septum and turbinate relieved his headaches. At a later date the osteoma was removed through a supraorbital incision.

The authors argue that the barotrauma induced through the submarine submersions aggravated the already existing sinusitis and predisposed him to the development of the small osteoma which had not been present 10 years ago. This would lend support to one theory of the genesis of osteomata, namely, inflammatory processes.

Shaw's patient[101] was a 58-year-old woman whose complaint was intermittent attacks of mental confusion and weakness of the limbs. X-rays showed a large osteoma of the posterior ethmoid and a pneumatocele. This was on the same side in the cerebral hemisphere, both subdural and intracerebral. Apparently the symptoms of weakness in the limbs and mental confusion were due to some local compression and irritation. There was no sign of rhinorrhea.

The mass was removed via a transfrontal craniotomy and was found to have invaded

the cribriform plate into the brain. The dural lacerations were patched with fascia lata. Recovery was complete except for a persisting anosmia.

Lederer, Snitman, Skolnik, and Soboroff [102] call attention to the importance of pursuing nasal polypi to the point of origin and of routine histologic examination of the tissues. In many cases the polyps may represent an actual change in the tumor or may overlie and obscure the real growth. While there are many types of benign tumors encountered, some of these may be benign histologically but malignant clinically. Consequently every diagnostic means at our disposal must be employed to obtain a correct diagnosis upon which the success of therapy depends. The treatment is essentially surgical, involving in most instances an external approach such as the Ferguson. Irradiation either through intracavity implantation of radium or deep x-ray externally is recommended postoperatively.

According to Clevici et al.,[103] "based on clinical allergical and histological observations made in 50 cases of nasal polyps, the authors believe that the etiopathogenesis of these new growths may be ascribed to four different factors: the anatomical structure of the rhinosinusal mucous membrane, the vasomotility of this mucous membrane, a constitutional condition of extra-allergic hyperergy and an attenuated chronic inflammation. None of these factors could, by itself, explain the genesis of polyps, but all of them co-operate in their formation. From the histological point of view, the following findings appear to be of some interest: the presence of a great number of lacunae full of an oedematous liquid containing small quantities of proteins and mucopolysaccharides: the presence sometimes of an aspecific infiltration around the vessels, as has been described for dysergic-hyperergic conditions; the existence of 'mastzellen' which may be held responsible for precollagenous fibrils, being the last of histologic characters of these polyps."

Fox [104] classifies nasal polyps under five headings: edematous, fibrous, angiectatic, glandular, and cystic. The treatment is divided into three stages: immediate treatment of acute symptoms, surgical and medical curative treatment, and postoperative prophylaxis. The immediate treatment is directed toward improving ventilation and drainage by way of vasoconstrictors, irrigation, antihistiminics, and removal of single obstructing polyps. The curative stage comprises the removal of all diseased tissue, including polyps, and the judicious use of steroids. For prophylaxis it is important to isolate and eliminate offending allergens. Recurring polypoid tissue may be lightly cauterized with trichloracetic acid. Also in stubborn cases deep x-ray or radium therapy has proved of value.

According to Van Alyea,[105] the commonest benign growths of the antrum are polypi and cysts. These are not always asymptomatic but may give rise to frontal headache, fullness of the cheek, postnasal discharge, and a long train of general symptoms. Contrast media instilled into the sinus are very helpful in outlining these growths.

Occasionally a simple cyst is emptied in the course of a routine antrum puncture, but recurrences will be an indication for a sublabial operation. The same applies to recurring polypi.

Galioto [106] shows the photographs and x-ray pictures of an enormously enlarged nose due to the pressure of ethmoidal nasal polypi. The patient, a man of 55, had neglected and disregarded the nasal obstruction and gradual enlargement of the nose over a period of 10 years. Not only was the lower cartilaginous portion of the nose expanded, but the nasal bones were completely separated from their attachment to the frontal processes of the maxilla. The patient was seen one year after the polypi were removed. There was no recurrence of the growths, but the nasal structure itself had not returned to normal although there was some reduction in its size.

Weille and Gohd [107] conducted some experiments to prove the virus theory of polyp etiology by passing polyp suspension through a series of chick eggs. The suspension was injected into the allantoic fluid, from which it was later extracted and reinjected into another egg, and so forth up to five or more successive implantations. It was found that the polyp suspension incited chemical changes by increasing the proteins. This manifested up to at least the fifth passage. "The incitant following filtration retains almost all of its activity," which fact strongly suggests a virus. However, attempts to produce tissue changes in the nasal mucosa of animals have not been successful. The work has been sufficiently productive to encourage further studies in the hope of fulfilling Koch's postulates for proving an etiologic basis.

Feingold [108] states that "most myxomas of the jaws are formed from the mesenchymal part of the tooth germ rather than from osteogenic cells." In the case which he reports a 36-year-old man complained of severe pain in the maxillary molar region. X-rays revealed a circumscribed radiolucent area at the apices of the first and second molars. It was exposed through an alveolar incision and presented as a grayish-white mass which extended into the antrum. Since it was adherent it was not entirely removed at the time. The histologic report of tissue removed was neurofibroma with myxomatous degeneration. A second operation was performed, affording a wider exposure, and the remainder of the mass was removed by sharp dissection. The final diagnosis after histologic study was myxoma.

A fibroma involving the maxillary, ethmoid, and sphenoid sinuses in a girl of 15 was reported by Leroux.[109] The symptoms of three months' duration were headaches, repeated epistaxis, swelling of the cheek, and loss of vision on the one side. X-rays showed a diffuse opacity of the three sinuses. Optic atrophy was already present. The mass was exposed via a sublabial incision and was removed piecemeal with very little bleeding. The histologic picture showed masses of typical fibroblasts arranged in whirlpool patterns, no evidence of sarcomatous change.

Ries Centeno, et al.[110] report a case of dentigerous cyst containing a tooth, which occupied the greater part of the antrum. The constricted sinus became infected and formed a draining fistula near the second molar. The process was attended by severe infraorbital pains, foul discharge, and, later, some infraorbital swelling. X-rays revealed the cyst and the foreign body, which were removed in the usual manner.

Lishchinski [111] reports two cases of cystic dilatation of the maxillary sinus. In one case, a 20-year-old man complained of headache, nausea, and chest pains for a period of four months. One cheek was swollen and tender. There were no ocular symptoms.

The sinus was opened, revealing an expanded sinus containing a thin watery fluid. The thickened mucosa was covered by a layer of shiny pearl-like epidermis. Histologically it showed considerable fibrous infiltration with numerous new blood vessels. The symptoms persisted for several weeks but finally subsided.

The second case was similar, but the excised mucosa showed marked infiltration with granulation tissue.

Kruchinina's patient [112] was a child of 5 who for several months had been developing an asymmetry of the face with exophthalmos, impaired vision, nasal obstruction, and discharge.

Operation disclosed a mass filling the antrum, which clinically appeared to be a fibroma. However, it was rather soft and had to be removed piecemeal. Histologically it proved to be a cementoma. The growth soon recurred and was again operated upon, after which a course of deep x-ray therapy was given. This failed to halt the progress of the disease, for at a third operation it was proved to have ex-

tended deeply into the orbit and the other sinuses, and the histologic examination now revealed a sarcoma. Irradiation failed and the patient succumbed.

Olven and Stahle[113] show an odontoma beautifully outlined in two planographs. Also a picture of the tumor which measured 1.5×1 cm. It originated in the region of the second left upper premolar and was easily removed. It was stony hard and bulged into the antrum. Histologic examination showed the characteristic picture of an odontoma which in this case contained a cyst, which was filled with necrotic material, inflammatory cells and some cholesterol crystals.

Pistolesi and Ruffato[114] describe the findings in a case of true cholesteatoma of the frontal bone in a woman of 35. There was a history of trauma to the forehead some 20 years before the appearance of the tumefaction. The area involved, about the size of an egg (pigeon) in the frontal boss was clearly defined in the x-ray pictures, showing a smooth round cavity with sharply defined bony borders. The frontal sinus, when exposed, was found to be small and showed no evidence of inflammatory reaction. The cystic mass had eroded one wall of the sinus as well as the table overlying the meninges. The contents of the cavity consisted of an amorphous mass of cornified epithelium and cholesterin crystals with fat deposits. The lining was a stratified epithelial and connective tissue formation showing tendencies toward papillomatous proliferation.

The authors discuss differential diagnosis from lesions such as metastatic carcinoma, tuberculosis, gumma, and plasmocytoma.

Toussaint[115] reports a case of a tumor arising from the greater wing of the sphenoid and projecting into the orbital cavity, causing exophthalmos and pain in a woman of 47. The x-ray pictures, including planographs, seemed to indicate an osteoma, but biopsy revealed a meningeoma encased in a hyperostosis. Histologic sections showed both bony structure with typical Haversian canals and meningeomatous cellular formations with spherical vacuolated cells.

Filgueiras and Bevilacqua[116] state that "globulomaxillary cysts develop from residual epithelium along the line of fusion between the nasomedial (globular) and maxillary processes." They are usually symptomless until some complication arises, such as an acute inflammation or a noticeable displacement of a lateral incision. A case of this type was seen in a 13-year-old girl. She had a temperature of 102 F and complained of pain and swelling. A spontaneous discharge of pus appeared through the gingival crevice between the lateral incisor and cuspid. Symptoms subsided after the administration of penicillin. The x-ray pictures show the large area of rarefaction forcing the roots of the two teeth apart. The bony roof of the cavity was uncapped and the area cleaned out. Subsequent x-rays showed considerable bony degeneration. The histologic examination of tissue removed demonstrated the stratified epithelial lining of the sac.

Simonetta,[117] reporting a case of chondrosarcoma of the upper jaw, discusses the association of the growth with Paget's disease. The mass occupied the entire maxilla, extending into the alveolar area and into the cheek. It was removed through a modified Patterson approach, the upper lip being left undivided. The maxilla was taken out and the mucosa of the cheek sewed directly to the mucosa of the divided palate.

The question about Paget's disease in combination with the chondrosarcoma was raised because of the difference in the histologic appearance of the medial or palatal portion from the main maxillary portion. The principal mass in the jaw was typically chondromatous, whereas the palatal portion consisted of bony trabeculae with fibrous components. The author quotes Agazzi and Belloni, who interpreted Paget's disease as a preblastomatous state. In this case the combination with a chondrosarcoma would appear to be a new observation.

Bandiera, Torloni, and Abrão[118] report three cases of eosinophilic granuloma, one of which was located in the frontal bone of a 2-year-old child. There was a history of a contusion sustained two months ago which was followed by the appearance of a swelling. X-rays showed a circumscribed area of bone absorption over the frontal bone surrounded by a ring of denser bone. The mass was exposed through a supraorbital incision and found to be friable and of a dark brown color. Histologic sections showed typical masses of eosinophils, histiocytes and some giant cells. X-ray therapy was employed in two exposures of 1000 r each. There was no sign of recurrence at the end of three years.

Surgery

Hernandez, Schwartman, and Silva[119] decry the attitude of some who are opposed to surgery of the sinuses and whom they call "non-interventionists." They admit that allergy plays an important role in many cases, but insist that when complicated by a bacterial infection the pathology that results must in many cases be dealt with surgically.

In deciding whether surgery is indicated the authors point to three factors which must be studied, namely, the anatomic conformation of the sinus, the clinical type of the disease, and the status of the lining mucosa. The size of the frontal sinus plays an important role in such a decision because of its extreme variability. Small frontals (less than 18 mm. transverse) present no ectasia-producing (*ectasigenos*) elements. Large sinuses (over 30 mm. transverse) present ectasia-producing products in over 80% of the cases. They quote Bergara as stating that frontals under 18 mm. diameter are amenable to intranasal procedures, that an intranasal operation, such as widening the nasofrontal canal and resection of the middle turbinate and the septum, is effective. Sinuses over 30 mm. in diameter must be dealt with through an external approach.

Anatomic deviations in the maxillary sinus that may influence the type of surgery required have to do mostly with unusual intrasinus septums that loculate the cavity and present a problem in drainage. Very extensive ethmoids and sphenoids are more likely to require surgery than smaller ones.

The type of infection and the status of the lining mucosa are determined by lavage and cultures, and by filling the sinuses with contrast media for x-ray studies.

Rauch[120] describes the development of the transantral ethmosphenofrontal operation which is now known as the DeLima technique. He claims that Pietrantoni expanded the Caldwell-Luc operation to take in the ethmoids and sphenoids, whereas DeLima went a step further and showed how the lower portion of the frontal sinus could be opened up by infracting the posterior wall of the nasofrontal duct from behind through the exenterated ethmoids. A number of drawings show the areas that are encompassed by this procedure. Also several cases are cited, together with x-ray pictures of sinuses with contrast media.

The author discusses the hypalgesia and anesthesia which follow in many of these cases and which cannot be entirely avoided. He claims, however, that in his series these symptoms disappeared in 90% of the cases after 12 months.

In the 72 cases operated on by this technique, there were three cases of postoperative meningitis and one case of encephalitis, all of which subsided under antibiotic therapy.

Sokčic[121] favors obliteration of the frontal sinus and complete exenteration of the ethmoids in chronic infections. Efforts to maintain the patency of the nasofrontal duct have, in the main, proved unsuccessful, and this in the past has accounted for recurrences and for endocranial complications. Obliteration of the frontal sinus and the duct, combined with ethmoidectomy, offers the best prognosis for prompt healing and is the method of choice also in the case of craniocerebral injuries in military operations. The resulting deformity is of no great importance and can easily be corrected at a later date by plastic surgery.

Simpson[122] reviews the various surgical procedures and indications for operation in each of the sinuses. These include incision and drainage in acute osteomyelitis of the maxilla in infants; antrostomy and Caldwell-Luc procedure in chronic antrum disease, alveolar fistulae and fibrous displasia, and other bony changes, cysts and tumors, and the various procedures in chronic ethmoid, frontal, and sphenoid disease. Some of the technical details of the external frontoethmoid operation are illustrated.

McAuliffe[123] refers to studies made by him and Dr. Harold G. Wolff with reference to sensitivity of nasal and sinus mucosa to touch and to pressure. ("Experimental Studies on Headache," etc., Williams & Wilkins Company, 1943.) The direction in which pain was referred from stimulation of these various areas are all mentioned. Summarizing the results in 112 cases in which the Caldwell-Luc operation was performed, he finds that soft tissue reactions in the past have been due to rough handling of the tissues and prolonged retraction of the soft tissues; also to excessive infiltration with the local anesthesia.

The author describes the technique which he has followed, which has been attended by little reaction and prompt recovery. After the usual incision the soft tissues are carefully separated from the bone by blunt dissection with a gauze-covered Kelly clamp. Care is taken not to traumatize the infraorbital nerve. After the sinus is opened the diseased membrane is removed. Normal looking mucosa is left in situ. The counter incision is started with a trocar through the inferior meatus; the bone is removed widely anteriorly, posteriorly, and inferiorly, after which the mucous membrane flap is laid down into the sinus. No packing is used. Postoperative care includes cold compresses and cortisone 25 mg. every four hours. This has been found very helpful in the asthmatic cases, a number of which were included in this series. All tissue removed is examined histologically and cultured. An autogenous vaccine has been found helpful in many cases.

Diamant and Ottoson[124] claim that recurrence of polypi in the nose and sinuses can be avoided in 90% of the cases through radical pansinus exenteration. In support of this claim they offer the result of their experience in 417 unilateral operations in 248 patients over a period of 18 years with follow-up of the patients for periods of 2 to 17 years. The influence of allergy is apparently minimized, for the authors claim good results despite the allergy. They state that success is due to having an experienced operator do the surgery in all cases, while an independent observer rules on the efficacy of the procedure in subsequent examinations.

The technique employed is a transantral exenteration of all the lining tissues of the antrum, ethmoids, and sphenoid; the nasofrontal duct and lower part of the frontal sinus are attacked through the nose. Care is taken not to disturb either of the turbinals.

If the condition is bilateral each side is done separately with a three-week interval.

Ronis[125] describes the trephine technique for acute frontal sinusitis and the Lynch procedure for chronic cases. In a series of eight cases of the latter, two required subsequent reconstruction of the nasofrontal duct, using the technique suggested by Boyden.

Maxillary sinusitis in most cases yielded to conservative therapy, 92 out of 100 clearing up under repeated lavage and antibiotics. Of the eight remaining cases, five required an intranasal antrostomy, while three were subjected to a Caldwell-Luc operation and transantral ethmoidectomy.

Frazell[126] advocates early radical surgery for carcinoma of the antrum and vicinity, reserving irradiation either as a postoperative measure or as the principal therapeutic agent in the inoperable cases. He shows the technique of removal of the superior maxilla with exenteration of the orbit through a Weber-Fergusson approach. The raw areas are immediately covered with split grafts, which shortens the postoperative healing process immeasurably. The records of the

Memorial Hospital in a series of 173 cases treated from 1937 to 1947 indicate a five-year cure rate of 22.5%. In the earlier years primary emphasis was placed on irradiation, with surgery playing a secondary role. In recent years this procedure has been reversed.

Laskin and Robinson[127] illustrate a procedure which they have employed successfully for the closure of an oroantral fistula. A single flap is raised, consisting of the mucosa and periosteum of the buccal aspect of the alveolus and continued beyond the sulcus to take in some of the buccal mucosa. The flap widens from its beginning on the buccal side of the fistula as it continues outward to the cheek, thus providing a broad base for adequate vascular supply.

Wurmová[128] (English Summary): "A report is given on the method of treatment of oroantral communications. In 19 out of 24 cases primary suture or primary plastic closure of the oroantral communication was carried out, without surgical intervention in the maxillary sinus. In 13 cases of infected maxillary sinus, along with the plastic closure of the communication, fenestration was carried out into the lower nasal passage, or temporary fenestration of the maxillary sinus beside the plastic closure which has well proved its worth. In the remaining 10 cases the communication was temporarily closed by an acrylate plate coated by zinc oxide eugenol paste. The larger part of the communications (even wide ones) closed up spontaneously."

Mandic[129] found it advantageous to combine the repair of alveolar antrum fistulae with the Caldwell-Luc procedure at one sitting. He has successfully operated on 12 such cases, 7 according to the procedure described by Dean and 5 by Ashley's method.

The article illustrates a number of techniques, such as the Dunning, Axhausen, Major, Ashley, Hill, and Russell.

Bagozzi[130] reports three cases of post-traumatic fistulae between the cheek, the antrum, and the palate, which were closed by rotating a flap of skin or mucosa for the deep layer, which was then covered with a free skin graft.

Norman[131] describes a procedure for closure of an oroantral fistula which is a combination of the Caldwell-Luc and the Berger procedures. The incision is a long Caldwell-Luc that extends downward into the affected alveolar space. This flap is longer than the usual Caldwell-Luc. After the antrum is cleaned out, "the buccal flap is mobilized by using the Berger technique of incising the periosteum of the flap parallel to the sinus floor. The periosteal incision made from within outward and opened by linear tension on the flap, allows the operator almost unlimited mobilization of the flap."

The author states that this procedure has been successful in eight successive cases.

Montandon,[132] in one of the cases reported, describes a chronic frontal sinusitis operated upon numerous times during a period of 20 years with frequent recurrences. The author finally was able to line the nasofrontal duct with a cutaneous hinged flap derived from the midfrontal region. He also claims to have successfully used a free graft in the maxillary sinus to cover a wide denuded area following the removal of an intracavity osteoma.

The other case was in a youth aged 18, presenting a mass in the roof of the nasopharynx which was diagnosed as a fibroma. However, increasing loss of vision led to further studies. X-rays showed a mass occupying the body of the sphenoid, invading the sella and extending down into the nasopharynx. Biopsies of the latter area were inconclusive, but the consensus based on the site of the growth and its development was that it was a malignant tumor, probably osteosarcoma. Since it was inoperable, the patient was put on irradiation therapy.

Tremble,[133] in doing an external frontal sinus operation, takes note of the level of the cribriform plate, which is in a line slightly higher than Reid's base line. The sinus can always be entered safely just above the groove for the lacrimal sac and on

a level with the roof of the orbit. The bone is removed as far as the supraorbital notch. In very extensive frontals it may be necessary to extend the bone removal outward, thus sacrificing the nerve. The mucosa of the sinus is not removed unless it is polypoid. All diseased frontoethmoid cells are exenterated and enough of the ascending process taken away to permit better visualization and provide room for the drainage tube. Tremble uses a 10 mm. polyethylene tube which is covered with a thin skin graft and secured within the sinus and enlarged ostium. It is left in place for four to six weeks.

Goufas and Gominatos[134] employed a technique similar to the Lothrop or Sebileau procedure for draining a bilateral frontal sinusitis. A case in point was in a man of 71 who had a draining fistula in the upper lid which led into a huge frontal sinus. The intersinus septum was destroyed. The area around the nasofrontal duct openings was enlarged; the spine was removed as well as the upper portion of the perpendicular plate of the ethmoid, and drains were inserted into each frontal, crossing each other above the septum.

Jakobi[135] describes a procedure for covering dura defects in the cribriform area, which was successful in five cases. Extensive loss of bone in this region was due to surgical excision of carcinoma of the ethmofrontal area in three cases, trauma in one case, and osteomyelitis in one. Destruction of bone in the cribriform plate invariably involves a laceration of the dura, often with loss of substance and resulting rhinorrhea. These defects were successfully covered in four cases by means of a frontal skin flap turned inward and held in place by tampons. In one case it was necessary to support the flap with an implant of beef bone to prevent prolapse through the large bony defect.

Boyden[136] reports two cases of malignant exophthalmos in which the Sewell approach was employed. This operation is considered less disfiguring and formidable than the Naffziger transfrontal operation. It consists of a transethmoid approach with removal of the lamina papyracea down to the optic foramen, whose lateral margin is removed to decompress the nerve. The floor of the frontal sinus is taken down, the ethmoid labyrinth exenterated, and the orbital fascia incised to permit the orbital fat to expand into the ethmoid space.

In one of the cases both sides were operated on and the result was good. In the other case one of the eyes had to be removed because of an endophthalmos. The other side was decompressed, which resulted in recession of the exophthalmos. However, the vision remained poor because of the extensive scarring of the cornea due to the prolonged ulceration.

Walsh and Ogura[137] describe their procedure for relieving malignant exophthalmos, which was successfully employed in seven cases. In effect, it is a transantral ethmoidectomy with removal of the floor and mesial walls of the orbit, incising the periosteum, and allowing the orbital contents to expand into the sinus cavities thus exposed. It is a combination of the Hirsch and Sewell operations without the disadvantage of the external incision. The danger of infection is minimal, and about the only disagreeable after-effect noted in some cases was a residual numbness of the cheek. The illustrations depict the various steps of the operation and cases before and after.

Dietrich[138] describes the technique of producing a prosthesis to overcome a large deformity resulting from the removal of the orbit and its contents. It was made of a plastic material with the artificial eye incorporated, and fitted into the patient's upper denture.

Moreau and Caux[139] describe endonasal curettage of the ethmoid cells with preservation of the middle turbinate, which is infracted to afford wider access, a technique which they ascribe to Portmann. They claim that the Moure curette when used properly will avoid the danger of injuring the cribriform plate or perforating the lamina papyracea.

Pagnini and Comoretto[140] report excellent results in a series of 166 transmaxillary ethmoidectomies by the Pietrantoni-DeLima technique. These are long-range results that were checked with respect to both objective and subjective symptoms. They found a high percentage of the cases to be bilateral, especially the hyperplastic types. Purely suppurative infections were found to be unilateral in most cases. The operation is indicated in nasoantral polyps, hyperplastic sinusitis, and chronic purulent sinusitis. Even in the allergic types that have undergone frequent intranasal procedures for removal of polyps, their results from the operation they favor have been good. In these instances they advise preoperative allergy therapy and postoperative radium therapy. In many of these cases there is a definite overlay of bacterial infection.

Every effort is made to avoid damage to the middle turbinate in this operation. In some cases, in order to accomplish this, they find it feasible to do part of the exenteration intranasally.

The authors comment on the persistence of headache in some cases; in one instance they surmised it was due to a chronic perisinusitis. In another place they assume that it is due to a reflex angiospastic mechanism arising from the pericarotid network.

Kruisbrink[141] demonstrates a prosthesis to close the large defect of the hard palate resulting from the excision of a rhabdomyosarcoma. Since the lesion was situated in the midline extending into the alveolus, it was necessary to remove the greater part of the entire hard palate including a portion of the alveolus, the septum and part of one naso-antral wall. The prosthesis provided an adequate closure for the maintenance of good function. Fortunately the soft palate remained intact, which was a great help for speech and deglutition.

Nonsurgical Therapy

Turletti-Tola[142] assumes that the pathologic status of a tissue depends on the deficiency or excess of the chemical elements present, which affect the level of the molecular activity. The Niccolini method of intravenous injection of certain chemical elements can affect the electromagnetic field in the tissues, restoring the molecular physicochemical equilibrium. When spectrophotometric readings indicate an excess of certain elements, the injections, according to Niccolini, have the capacity of catalyzing or detaching the excess of ions. For example, the manganese ion can catalyze the calcium ion. Molybdenum, on the other hand, has the opposite effect. Cobalt has been found to be effective because of its inhibiting effect on cultures of Pneumococcus and streptococci. It is also stated that molybdenum favors the metabolism of oxygen, while cobalt is more effective in promoting that of hydrogen. Fifteen intravenous injections of these various elements were given in a period of 30 days. Success was claimed in three cases of chronic otitis media and one of chronic frontal sinusitis.

Clerici, et al.[143] injected cortisone and hydrocortisone in the submucosa of 83 cases of allergic rhinitis, 20 of which were hay fever cases. The dosage employed was 12.5 mg. cortisone into each side on alternate days for a total of 400 to 500 mg. The dose of hydrocortisone was 7 to 10 mg. into each side for a total of 250 to 300 mg. The material was injected deeply into the swollen membranes, including the turbinals. Biopsies were done before and after treatment and showed a reduction in the degree of submucous edema, which was attributed to a reduction in the glycoproteins.

The results in the hay fever cases were not encouraging but the authors claim that in the remainder of the group definite benefit was observed in 60% of the cases treated with cortisone and 80% of those treated with hydrocortisone.

Dreyfus[144] describes a new inhalation apparatus which he used in the aerosol therapy of asthma, bronchiectasis, and chronic sinusitis. Natural sulfur water from the spring at Bad Lenk i.S. was used, the particles being reduced to an average of 1

to 2μ. In addition the patients received Calcium Sandoz 10% plus Synophen Geigy in the daily inhalations. Pneumometric readings were taken before and after treatment. In the sinus cases uncomplicated by bronchiectasis, there was a definite reduction in the pneumometric values.

Moser[145] attempts to evaluate the role of chemotherapy and antibiotics in sinusitis. He finds the antibiotics most useful in acute cases and least effective in chronic cases. He has used penicillin in gelatin and agar with good results and attaches little importance to reports of ill effects due to allergic reaction or concrement formations. The great difficulty in using antibiotics lies in the varied bacterial flora encountered and penicillin-resistant germs. He could therefore not recommend using these agents in the mild cases, reserving them for the severe types, especially when complicated by osteomyelitis or intracranial extension.

As for penicillin in aerosol there are objections arising from reports of local reactions.

The question as to whether the solution should be instilled after irrigation via the middle meatus, or infraturbinal puncture is debatable in his opinion, although he is certain that in children the middle meatus is preferable because it avoids any danger to the tooth buds.

The true diagnosis in Liener's case[146] was not established until autopsy. The patient was a woman of 43 with active bilateral tuberculosis with cavitation, who developed meningitis in which the bacterial invader could not be determined since the spinal fluid was persistently negative. The sinuses were never suspected because the examination, including x-rays, was always negative. Autopsy revealed diffuse purulent meningitis with pyoencephalus and the ethmoid cells filled with purulent material. Cultures from all of these areas showed Aspergillus. The author attributes this mycotic infection to massive doses of antibiotics which were given the patient to combat the tuberculosis as well as several attacks of pneumonia.

According to Hussarek[147] the frequent occurrence of ear and sinus complications in cases of grippe are due to the affinity of the influenza virus for mucous membrane. In mild cases the bacterial flora indigenous to the area are unchanged. In severe cases the bacterial flora changes to more pathogenic types such as hemolytic Streptococcus. Sulfonamides and penicillin have no effect on the influenza virus or the secondary invaders. However, the "mycin" drugs do, and it is claimed that their effectiveness is due to their ability to penetrate the cell membranes to come in contact with the pathogenic agent.

Van Alyea,[148] discussing the nonsurgical treatment of sinusitis, advises against the use of antibiotics in the average routine case. They are valuable agents, but should be reserved for severe attacks only. Also, he feels that the use of penicillin locally has but little effect, since the instilled solution has little chance of contacting the organisms which are imbedded in the tissues. Irrigation of the antrum can be successfully accomplished by cannula through the natural ostium in most cases. Should the opening be inaccessible, the membranous septum can be perforated easily with a sharp cannula. Cases that fail to clear up after a reasonable course of irrigations should have an intranasal antrostomy. The radical Caldwell-Luc operation is only rarely required.

On the basis of results obtained from the use of oxytetracycline and penicillin in a group of proved cases of chronic maxillary sinusitis, Lumio[149] concludes that the former is more effective than the latter. The oxytetracycline was given in doses of 250 mg. for a total of 16 doses over a period of five days. The penicillin was given intramuscularly in doses of 450,000 units daily for a similar period. Patients were checked one week after therapy and again three months later. At the latter examination 90% of the patients treated with oxytetra-

cycline were symptom-free. The percentage in the penicillin cases was 86.3.

Side-effects, such as pruritis, eczema, and diarrhea, were much more frequent from oxytetracycline therapy.

Iodides in some form or other have for a number of years been considered effective in the treatment of chronic diseases of the upper respiratory tract. Goodyear[150] again calls attention to the beneficial results obtained by the injection of iodochloral (2 cc.) into the antrum every five to seven days in chronic cases. Obstinate cough in many cases was relieved within 48 hours. He no longer uses irrigations, believing that the water mixed with infectious material incubated at body temperature is likely to do more harm than good. The local use of penicillin is advised only in the treatment of acute or subacute infections of dental origin. The penicillin powder is mixed in water in concentration and injected for five consecutive days, then followed by iodochloral at four- to six-day intervals.

After antrostomies, Goodyear refrains from removing membrane or polypi, but packs the cavity with iodoform gauze which is left in place for five to seven days. Then at similar intervals the cavity is swabbed with a 2% to 5% solution of silver nitrate after light cocainization.

Schöler[151] claims excellent results in the treatment of chronic suppurative maxillary sinusitis through the use of broad-spectrum antibiotics by instillation. He found that staphylococcic infections yielded best to Supranol, Marbadal, Banecocin, and Terramycin; likewise streptococci. However, the Gram-negative bacteria were best treated with Gantrisin and at times the same antibiotics mentioned above. Sensitivity tests showed resistance in all groups of bacteria to penicillin, streptomycin, and tetracycline. The author used a 20% solution of either Supranol, Marbadal or Gantrisin, or a 1% solution of Terramycin with 5 mg. of neomycin and 250 units of bacitracin per cubic centimeter. Irrigations were done every three to four days. The results in 40 patients after 7 to 20 irrigations were complete cessation of all symptoms in 37, which was maintained for a year, during which time the patients were repeatedly examined. Two patients were operated on and both were diagnosed as allergic.

Cioce[152] claims that the combination of chloramphenicol with trypsin employed locally has yielded excellent results in the treatment of chronic otitis media and sinusitis. The trypsin makes it possible for the chloramphenicol to enter into an aqueous solution of a high concentration which is otherwise impossible. In the sinus cases which he cites, the solution was instilled after irrigation. Several treatments of this nature resulted in disappearance of all purulent and mucopurulent secretion.

Mills[153] reports good results from the use of a Staphylococcus bacteriophage lysate in treatment of chronic sinusitis caused by the antibiotic resistant Staphylococcus (Micrococcus pyogenes var. aureus). The lysates were administered by aerosol and were prepared by the Lincoln Foundation Laboratory in Swarthmore, Pa. They were identified as Gratia B-985 and selected from high polyvalent cells from two strains of toxigenic staphylococci. Starting with 0.25 cc. of the lysate, the dose is increased at one to three day intervals. Minor reactions have been noted in the beginning but tend to disappear as the therapy is carried on. During the course of the treatment daily nasal irrigations are carried out. If diarrheal symptoms appear, the lysate is used orally, 1 to 2 cc. in 30 to 60 cc. of water. Codeine is given at the same time.

Miller et al.[154] claim that streptokinase administered intramuscularly in conjunction with penicillin contributes materially to resolution in cases of acute sinusitis. They cite one case of acute frontal sinusitis with fever, pain, and local edema, in which resolution took place within a week. They used viridase, which is composed of streptokinase and streptodornase in a concentration of 10,000 units per cubic centimeter. They gave 5000 units twice daily along with 300,-

000 units of penicillin G, and streptomycin sulfate 0.5 gm. The function of the streptokinase is to remove the products of inflammation so as to permit the antibiotics to come into closer contact with the infected area.

Terracol et al.[155] suggest the use of cortisone by instillation into the antrum in cases of mixed infection where allergy is a factor. They show a picture demonstrating a fine polyethylene indwelling tube, through which daily irrigations and instillation of cortisone are carried out over a period of eight days.

Lemaire[156] claims good results in the treatment of chronic sinusitis from the use of therapeutic water which are instilled by the Proetz displacement method. One of these mixtures which he attributes to Bagnères-de-Bigorre, contains sodium sulfochlorides and the other from Salies is a calcium, magnesium sulfate. The latter is supposed to be slightly radioactive and is soothing and decongestive. The two may be combined in different proportions, depending on the degree of sinus involvement. The first named of the two is likely to cause more reaction than the Salies mixture and therefore will have to be reduced in proportion to the latter. At first the secretion is increased in amount, but diminishes after the first week and then disappears toward the end of three weeks. Instillations are done daily for five successive days of the week, thus allowing for a 48-hour rest each week end.

Clinical

Kartagener Syndrome.—An unusually large number of articles on the Kartagener syndrome appeared in the literature during the year. There seems to be a growing awareness of this phenomenon, which is of interest to us because of the involvement of the sinuses.

Fornatto et al.,[157] in reporting two cases of Kartagener's triad, present an analysis of the relationship between the upper and lower respiratory tract in the pathologic picture. Both cases are well documented, revealing the underdeveloped frontal sinuses, chronic pansinusitis, bronchiectasis, and complete transposition of viscera. The sequence of events in the appearance of the sinusitis and the bronchiectasis appears to be variable. At times one or the other takes precedence and in some instances they appear simultaneously. Congenital factors seem to be potent influences in the development of these conditions, although it is generally conceded that environmental factors and allergy play a major part in the picture.

In one of the cases a lobotomy and a bilateral antrostomy afforded considerable relief from the cough and nasal drainage, though not completely eliminating these symptoms. Displacement therapy seemed to be beneficial in the postoperative period.

Nichamin[158] had a case of Kartagener's syndrome in a newborn, which was diagnosed within the first 48 hours because of symptoms of respiratory difficulty and nasal discharge. X-rays showed dextracardia, atelectasis, and cloudy ethmoids and antrums. Subsequent x-rays with opaque medium showed a normal bronchial tree, which leads the author to the observation that if these cases could be diagnosed early enough one might be able to forestall the development of bronchiectasis, which is a common finding in all cases seen later in life.

An extremely interesting case of Kartagener triad is presented by Parrella and Rescigno[159] in a 16-year-old girl. In addition to dextracardia there was total absence of the right lung, the apical area being supplanted by the rudimentary hyperdilated bronchial tubes of the upper and lower lobes. Also agenesis of the frontal sinuses was demonstrated and the maxillaries were also underdeveloped. As is usual with reports of this syndrome, much space is given over to a discussion of the hereditary factors in this process.

The case reported by Kartagener and Mully[160] was in a woman of 22, who underwent three resections of portions of the

lungs with complete recovery. In this case there was no evidence of any sinus involvement.

The article is a lengthy one, since it includes a complete bibliography listing all cases reported from 1937 to 1956, a total of 216 cases.

Von Finkler [161] compares his statistics on the incidence of situs inversus and bronchiectasis with those of other countries, particularly Norway. The Kartagener syndrome is much commoner in Israel and the Arab countries, but bronchiectasis in combination with it is much less frequent. On the other hand, the incidence of bronchiectasis and pulmonary cysts without situs inversus is greater in Israel than in Norway. In both cases the percentages are very low. For instance, the author, reviewing 20,000 x-ray films, found situs inversus present in only 0.02%. This is about the same as in Vietnam and North Africa. However, in a series of about 250,000 x-ray examinations the combination of situs inversus and bronchiectasis was found only twice.

The report of Northrup and Van Lierle [162] makes no mention of the sinuses.

In the case reported by Proba [163] the patient had been treated for tuberculosis, when the condition was a bronchiectasis in a typical case of situs inversus.

A case report by Liwszyc and Surdacki [164] includes mention of maxillary sinusitis in association with bronchiectasis and exudative pleuritis, with a general transposition of the viscera.

Fried [165] collected 20 cases of situs inversus and catalogued all the findings in a chart. He shows that 11 of the 20 patients had most if not all of the characteristic signs of the Kartagener complex, and 4 of the 13 females had cystic tumors of the generative organs. Furthermore, he was able to determine the presence of other anomalies.

All of this leads the author to the conclusion that situs inversus should not be dismissed as a plaything of nature, but should be thoroughly investigated for other anomalies, which can usually be found in greater or less numbers. It is important that all the facts be known in every case as a basis for protecting the patient against mishap and as an indication for early therapy whenever possible.

Grange et al.[166] had a 12-year-old girl of Eurasian parentage who exhibited all the clinical evidences of the Kartagener syndrome. Both antrums were infected, and the frontals were undeveloped. The bronchiectasis was confined to the left lung and was successfully combated by a lobectomy. The sinus condition improved under antibiotic aerosol therapy.

The case of Frank and Desai [167] is reported because of a coronary occlusion which caused the patient's death. There is mention of a sinusitis in this case but no details are given.

Resection of the left middle lobe was successfully carried out by Moore and Silver [168] in a man of 20 with Kartagener's syndrome. Both of the antrums appeared to be the seat of chronic infection, but no mention is made of any therapy in this direction.

Samsoe-Jensen's [169] patient was a 7-year-old boy who manifested bronchopulmonary symptoms from the first postnatal day. The dextroposition of the vital organs was discovered at the age of 2. Despite adenoidectomy and a Claoue operation on the antrum, there was very little improvement. Large doses of penicillin had little effect but some improvement followed a regime of respiratory exercises and training in expectoration. The advice of the thoracic department that a pulmonary resection be done was rejected by the parents.

The case of Kartagener's triad reported by Deutsche [170] was in a 21-year-old white man who also was suffering from acute rheumatic fever. X-rays showed dextracardia, bilateral bronchiectasis, and clouding of both maxillary and ethmoid sinuses. The frontal sinuses appeared rather small but fairly symmetrical.

Cordeiro[171] was impelled to report his case of Kartagener syndrome for several reasons. First, because of the rarity of the disease and this being the first to be reported from Portugal. Second, because the case could be fully documented from all possible angles and, finally, because of certain associated abnormalities. In addition to the complete situs inversus, rhinosinus pathology and bronchiectasis, they were able to demonstrate a megaesophagus and a right bundle branch block. All of these items are illustrated by the x-ray pictures and electrocardiograms.

The case reported by Martinez[172] was in a girl of 7 who had a complete transposition of all the viscera and, in addition, a syndactylism of the right middle and fourth fingers; also an equinovalgus of one foot. There was no mention of the status of the sinuses.

In the case of Kartagener syndrome reported by Chenebault and LePape[173] the sinuses appeared normal. However, in addition to the transposition of the viscera there was a marked bronchiectasis, anomalies of the costal cartilages, and an active pulmonary tuberculosis. The patient was 32 years of age.

Maxillary-Dental.—Mašura[174] discusses the problem of tooth roots displaced into the antrum. Whenever possible the foreign body should be removed promptly. Infection will usually supervene, although in some cases the displaced fragment may remain in the antrum for a long time without causing trouble. He does not favor removal through the alveolus but recommends the Caldwell-Luc approach. Diagnosis in all cases can readily be made by x-rays, especially planographs.

Livingstone[175] states that sarcoidosis is a systemic disease, and the nasal mucosa, especially over the inferior turbinates, may be the portal of entry. The case which he reports was in a woman of 48 who was treated for iritis. A septic focus was found in the lung. Some improvement was noted under streptomycin and cortisone therapy, but secondary glaucoma developed. Glands appeared in the neck and groin, one of which was removed and reported as "sarcoidosis." The same was found in one eye, which had to be enucleated. Nasal symptoms at that time consisted of purulent discharge and obstruction. X-rays of the sinuses showed completely opaque antrums. A bilateral Caldwell-Luc operation was performed, and the thickened membrane which was removed also revealed sarcoidosis. Three months later the patient reported the nasal condition satisfactory aside from some crusting.

In presenting the histories of five cases of caseous sinusitis, Lombardo[176] proposes dividing these "cholesteatomas" into two groups, primary and secondary. The former would be a dysontogenetic metatype and the latter a metaplasia, possibly from an islet of epidermis. He is under the impression that the primary type is more commonly seen in the frontal sinus, rarely in the maxillary. Caseous sinusitis are not really cholesteatomas. They originate from regressive transformation of exudates and anatomical elements of the inflamed lining. There are usually of dental origin.

A case of aspergillosis of the maxillary sinus reported by Anderson and Stenderup[177] was in a woman of 55. The symptoms were allergic in nature with polypi and a very dark antrum on x-ray. The fungus was recovered in the secretion at operation, and an extract made from this material provoked a strong reaction when applied to the patient. Allergic symptoms persisted after the operation. Antiallergic therapy and iodides were tried without effect.

An ectopic molar in an 18-year-old youth was responsible for a fungating necrotic maxillary sinusitis, as reported by Bompoint and Trombetti.[178] The patient recalled some acute disturbance in the left molar area some years back which subsided and then recently reappeared in the form of a painless swelling in the cheek. X-rays revealed a tooth in the lateral antrum wall. Operation disclosed a soft anterior bony

wall, the sinus full of foul fungating material, partial absorption of the floor of the orbit, and a tooth tightly imbedded in the lateral wall near the malar prominence.

Among the cases reported by Centeno [179] were two of severe acute maxillary sinusitis due to retained third molars. In one case the infection reached the sinus via a fracture of the alveolus in a previous attempt at extraction. The route of infection in the other case was not stated, although it was very likely due to trauma. In both cases the acute sinusitis was accompanied by pain, temperature, and swelling of the cheek. After the acute symptoms had been controlled by antibiotics, the sinuses were cleaned out through a Caldwell-Luc procedure and the retained molar extracted at the same time.

Wade [180] had three cases of antrum infection following tooth extraction, with dislodgment of a root fragment into the sinus. In two of the cases an acute infection developed in the antrum. Under antibiotic control the tooth fragments were removed through the alveolar perforation by irrigation and forceps. When the acute symptoms had subsided, the fistula was closed by buccal and alveolar flap.

Haberman [181] discusses infections of the retromaxillary space and reports 10 cases, 4 of which were due to extension from a sinus infection. One case followed a sinus puncture and was readily controlled by antibiotics. A second case following sinus puncture developed three weeks later with trismus, swelling of the cheek and jaw, radiating pains, fever, and chills. A meningitis supervened. The area was drained through the posterior sinus and apparently the patient recovered. Another case ended fatally from extensive thrombophlebitis of the cranial sinuses. In this case, however, the sinus could be implicated only as a secondary factor, since there was evidence of recent extraction of teeth. The fourth case was not severe, being controlled by antibiotics.

It appears that in three of these cases the infection was due to penetration of the needle in misdirected puncture.

Headache-Neuralgia.—Turnley [182] is firmly convinced that irritation of the sphenopalatine ganglion from pressure or contact between the septum and middle turbinate, even in the absence of clinical signs of ethmoid or sphenoid infection, is a frequent cause of hemicrania. He describes the syndrome, as did Sluder, in which a stuffy sensation is followed by dull unilateral headache with sensation of pressure behind the eye and radiating to the back of the head, the temporal region behind the mastoid and down the neck. It may come on in paroxysmal attacks or persist as a dull ache for a long period.

The author emphasizes the importance of looking for a high posterior septal deviation causing pressure on the middle turbinate. Resection of the deviated portion will relieve the pressure and the resultant pain. The operation will permit the turbinal to expand normally and will facilitate drainage from the ethmoids. The author states further that he has found this condition more prevalent among individuals whose facial structure is long and narrow. In these persons the nose is long and thin, and the meati quite narrow.

Canciullo and Motta [183] discuss the factors that enter into the production of supraorbital pain and attempts to differentiate true supraorbital neuralgia from pain due to frontal sinusitis. Localization of pain due to the latter differs from that of neuralgia, in which tenderness over the foramen is associated with hyperesthesia of the overlying skin area. In many cases recurring localizing headaches following acute sinusitis cannot be attributed to the sinus infection but are due to the affection of the supraorbital nerve. The authors recommend the injection of "Impletolo" (Bayer), which is a combination of procaine and caffeine. These injections are made every other day until the pain subsides. Several cases are shown in which pain persisted despite sinus

surgery and was only relieved by the injections.

Couch [184] considers the various causes of facial pain, which often presents a problem in diagnosis. The various conditions which may cause this symptom, and the psychological considerations which enter into the picture often make it very difficult to properly estimate the true status of the case. Among the conditions discussed by the author are temporomandibular pathology, oral pathology, otalgia, elongated styloid process, trigeminal neuralgia, glossopharyngeal neuralgia, sphenopalatine neuralgia, etc., etc. Sinus pain is considered the second most frequent and is described as deep, persistent, dull, and nonpulsating. The posterior group give rise to vertex and parietal headache, whereas the anterior group cause frontal headache, sense of fullness around the orbit, and dull aching in the upper jaw and teeth.

Piñeiro [185] discusses migraine as a complicating factor that accounts for the persistence of headaches originally attributed to an acute sinusitis, but which fail to disappear following adequate treatment of the latter. He finds these cases mostly in younger people and is impressed with the importance of obtaining a detailed history of the patient's background, which includes the family history, antecedent complaints, and behavior, as well as the general picture of his emotional status. Seven cases of this type are cited, and the author lays down the following plan of treatment:

1. Complete history as mentioned above
2. Adequate treatment of the sinusitis
3. Treatment of the headaches with Dihydroergotin
4. Psychotherapy
5. Treatment of contributing general dyscrasias

Miscellaneous.—An article in *Seminar International*,[186] which is unsigned, deals with the treatment of sinusitis in its various phases, and covers the average present day conception of the conservative nonsurgical therapy. Nothing new or radical is offered.

Natali [187] divides sinusitis into two groups, those that are nasal in origin and those that are odontogenic. His discussion of the diagnosis is brief and offers nothing new.

Terracol [188] discusses focal infection from the sinuses and mentions three conditions which are necessary to establish a connection between the sinus infection and the remote focus. These are that the offending organism is the same in both areas, that the disease progresses simultaneously, and that the metastatic focus subsides when the primary is properly eliminated. He claims that the sphenoid, the maxillary, and the ethmoid sinuses are most frequently the original focus.

The bacteria and their toxins are carried via the blood stream and lymphatics by the white cells, which phagocytose but do not destroy them. This process has been termed "bacteriopexie circulante" by Fiessinger.

The author lists the various organs that may become the seat of this transmitted infection, citing a number of references in support of this thesis. Most of these are rather ancient. However it would appear that the author still believes in the theory of focal infection and is interested in reviving it.

In this chapter dealing with focal infection, Whitaker [189] discusses the tonsils, the sinuses, and the teeth. He presents a long list of symptoms pointing to chronic sinusitis which indicate a latent, often undiagnosed, condition. These are (1) widening of the root of the nose, often observed in infants and young children; (2) nasal obstruction, mouth breathing and dry mouth; (3) formation of thin crusts in the nares; (4) secretion in the conjunctival sac with sticking of the lids; (5) conjunctivitis; (6) gritty sensation in the eyes; (7) frequent colds with nasal obstruction; (8) recurring dull headaches; (9) mental lassitude and inability to concentrate; (10) postnasal catarrh; (11) irritability; (12) impaired hearing; (13) frequent rheumatic pains, and (14) recurring laryngitis.

Careful examination of the nose and nasopharynx will reveal evidences of chronic infection in the ethmoids or sphenoid.

Thoma [190] explains the importance of differentiating fibrous dysplasia from ossifying fibroma, a neoplasm, because the therapy in each instance is different. In fibrous dysplasia it is only necessary to remove enough tissue to restore the normal facial contour, whereas the ossifying fibroma demands radical excision. Fibrous dysplasia is the result of "faulty osteogenesis, the cells failing to differentiate into mature osteoblasts." Enlargement and distortion are due to increased cell activity, and this is the result of the increase in the abnormal intercellular substance. Ossifying fibroma, on the other hand, developing from young connective tissue cells which become osteoblasts, increases in size through the mass of proliferating cells and encroaches on adjacent bone by osteoclastic resorption. It is not always easy to differentiate the two by histologic examination, and one may have to rely on the clinical examination which includes the x-ray studies. The presence of a defined capsule and a more uniform opacity will often clearly distinguish the neoplastic growth from the dysplasia. Several examples of both types are cited with clarifying x-ray pictures and histologic sections.

A case of fibrous dysplasia involving the alveolus of the maxilla in a 60-year-old woman was reported by Robinson and Fogel.[191] It developed early in life and after the age of 14 remained stationary for years. Diagnosis was made from a biopsy, and the excess bony tissue was removed after extraction of the teeth. The growth apparently did not involve the sinuses.

Stamm [192] discusses monostatic and polystatic fibrous dysplasia of the facial bones, pointing out the items which differentiate it from osteoporosis, von Recklinghausen's disease, xanthomatosis, Paget's disease, and osseous dysplasia. He sites Jaffe and Lichtenstein's description in which they ascribe the process to a fibrous tissue proliferation in the medulla absorbing the cancellous and cortical bone. This new fibrous tissue is later replaced by metaplastic bone, occasionally with islands of cartilage and cysts. Trauma is considered by many to be an inciting factor. It is important to recall that blood calcium and phosphatase are normal and that the mass usually appears ill defined in contradistinction to other growths which show well-marked borders. Also, it usually develops early in life.

Several cases are described in detail.

Bauer and Sutcliffe Kerr [193] report a case of monostatic fibrous dysplasia of the frontal bone in a man aged 37. X-rays showed an opacity of the right frontal sinus with irregular erosion of the bony walls. New bone formation was also seen extending into the floor of the anterior fossa. Angiography revealed no abnormality in the cranial circulation, and meningioma was ruled out. Osteomyelitis was unlikely because there was no history of trauma or infection. A biopsy revealed typical fibroid dysplasia.

A photograph of the patient at the age of 10 showed the same difference in the level of the eyes that was seen in the man at the age of 37.

Winslow [194] reports a case of Paget's disease in a man of 60, which was first diagnosed through x-ray pictures of the teeth. Large areas of osteoporosis in the cuspid and incisor region of the maxilla were demonstrated.

Guerrier [195] has found a connection between a syndrome of ethmoantritis, bronchiectasis, and "bouchon epidermique" to be the cause of subluxation or recurring luxation of the mandible.

The case reported by Cody [196] was most unusual because the patient was subjected to three craniotomies on the mistaken diagnosis of aneurysm. The symptoms were pains in the eye, temporal region, and neck, swelling of the lids, and exophthalmos. Nasal examination was negative, as were the x-rays. During the last cranial operation the clinoid process was accidently broken off, opening the roof of the sphenoid sinus, from which pus exuded. Subsequently x-rays showed the sphenoid to

be of large size with thick bony walls. It was opened through a transethmoid external approach. The anterior wall of the sphenoid was very thick, necessitating a gouge and mallet for entry. The sinus was filled with pus, cheesy material, and debris.

The author points out the failure to establish a diagnosis in the beginning was due to improperly taken x-rays inadequately appraised. The projections that are considered to be most helpful are the routine lateral and the Hirtz or mentovertex projections, both of which are shown.

Gentile[197] reports a case of a cholesteatoma of the frontal area which apparently originated from the dura and expanded into the orbit, causing a displacement of the bulb and compression of the optic nerve. It was about the size of an orange, and the pictures show it occupying the fronto-orbital region and causing distortion of the anterior cerebral artery. The frontal sinus apparently was in no way involved.

Surber,[198] reviewing 65 cases of chronic sinusitis, stresses the allergic action of the invading bacteria. Staphylococci are the commonest causes of prolonged infections (75%). Other allergens may be present, such as dust, spring grasses, and ragweed. Desensitization should be carried out along with injections of autogenous vaccines and Staphylococcus toxoid. While these measures afford considerable relief in most cases, there are a number which will eventually have to be operated upon because of irreversible changes. The author is partial to the transethmoid operation whereby the pathology is properly dealt with without disturbing functional tissues in the nose.

Fourteen case histories are given which reveal a variety of symptoms and complicating conditions such as arthritis, bronchial and orbital infection.

A careful study of cases of this sort is essential before the proper therapy can be determined, since in so many instances the combination of various contributing factors calls for a combination of both medical and surgical procedures. As a rule the more prolonged or chronic the case, the greater the likelihood that surgery will have to be employed.

Silcox[199] notes that allergy is the cause of over half of the nasal sinus complaints, is usually of the perennial type, and is so frequently overlooked and mistreated. While systematic treatment with antihistaminics and cortisone afford temporary relief, a cure cannot be expected without a thorough allergic study and desensitization where necessary. The author recognizes bacterial sensitivity as a frequent factor and in such cases recommends treatment with autogenous vaccines. Cases in which infection has been superimposed and the tissues have undergone extensive pathologic changes will have to be dealt with surgically.

Schnurbusch[200] reports two cases of pemphigus vulgaris which were under observation for three and four years respectively. In one case an atresia of the nares developed which, though relieved at the time through surgery, recurred, nevertheless, despite persistent dilatation with bougies. In the second case a partial atresia developed in the esophagus, but the passage was kept open sufficiently to permit swallowing by means of continuous bougienage. Despite recurrences at various periods, the progress of the disease appeared to be halted through the use of Echinacin, which seems to be able to control the disturbance of the balance between mucopolysaccharides and the mucopolysaccharases.

Mange[201] encountered a case of maxillary sinusitis which on lavage and cultures yielded the Klebs-Loeffler bacillus. The question as to whether the case was one of a primary diphtheria of the sinus or a secondary invasion by the bacteria into an already existing sinusitis was indeterminate. Diphtheria of the sinuses is generally a mild chronic infection which will escape detection unless cultures are made. When discovered, it is advisable to clean out the

sinus thoroughly because otherwise the patient will be a carrier despite lavages and conservative therapy.

Extensive involvement of the sinuses and nasal mucosa in a case of fibrocystic pancreatitis is described by Pennington.[202] The patient was a 6-year-old who had been followed since the age of 6 months. Nasal obstruction, at first thought to be due to choanal atresia, was found to be caused by large cystic middle turbinates. When these were removed, an absence of the nasolateral walls and floors of the orbit was disclosed. This was attributed to the long-standing pressure of the enormously expanded cystic turbinates. Examination of the mucosa revealed increased glandular structure with dilated lamina and extensive eosinophilic staining. It was similar to the bronchial mucosa in like cases and points to the process as being one of a generalized excretory glandular dysfunction forming the basis of the disease.

Kislova[203] reports a case of bilateral cystic dilatation of the ethmoid labyrinth in a 14-year-old girl. A swelling on one side of the nasal bridge appeared at the age of 3 years, causing slight displacement of the bulb. Later the interorbital space seemed to widen as the opposite side of the nasal bridge became involved. When exposed at operation, the thin wall on the one side gave way, permitting a quantity of clear fluid to escape. All of the surrounding bone on both sides was thinned out from pressure with exposure of dura posteriorly. Despite antibiotic therapy, a meningitis supervened, which, however, was fortunately controlled. Several months later there was a recurrence of the cyst on one side, probably due to inadequate drainage through the nose.

Trauma and Foreign Bodies

Withalm[204] presents the histories of seven cases of skull fracture involving the frontal sinus, in all of which, with one exception, primary conservative therapy was followed within a few weeks by intracranial complications necessitating radical surgery. This experience convinced him that the proper approach in these cases is the one that most rhinologists follow, namely, early wide exposure with ablation of the sinus. He claims that the general surgeon is prone to rely on antibiotics and primary conservative treatment such as removal of foreign bodies, raising depressed fragments, and primary suture.

(This assumption is in large measure erroneous, as a perusal of the literature will demonstrate.—S. S.)

According to Sokčic,[205] the incidence of injuries involving the frontal and ethmoid sinuses is increasing, owing not only to the development of industry and motorization of traffic, but also to kicks from horses. The sinus injury may be open or closed, depending on the integrity of the mucous membranes, not to the state of the facial skin. Further, the open injuries are penetrating and nonpenetrating in regard to the condition of the dura.

During surgical intervention special attention must be paid to the nasofrontal duct as well as to the lamina interna and the dura. It is very important to carefully avoid traumatizing the mucous membrane when opening the sinus, since the respiratory mobility of the membrane is a sign indicating the integrity of the nasofrontal duct. In the author's opinion, lesions of the lamina interna, the dura, and the nasofrontal duct are best treated by obliteration of the frontal sinus, since there is no satisfactory method of reconstructing the duct. Retention of secretions may develop, with subsequent intracranial complications. Obliteration of the frontal sinus eliminates the danger of late complications and obviates the necessity for drainage and lavage.

Shands[206] demonstrates the use of the transmaxillary Kirschner wire for fixing displaced and separated fractures of the maxilla. Traction may be obtained by means of a bow, a head and neck cast with hooks and rubber bands, or incorporating a Kirschner wire in the head cast: wiring

the jaws together is often necessary also to obtain proper occlusion. Two cases are cited.

Lesney[207] points out the bony buttresses which fortify the superior maxillae against trauma. These are mainly the zygoma, the pterygoid processes, and the palate bone. In cases where the upper jaw is fractured free it is more than likely that damage has been done to the pterygoid processes. It is difficult to demonstrate this in x-ray films, and one must therefore rely on thorough neurologic examination to rule out possible injury to the brain. Among the points brought out by the author in this connection are the following: State of consciousness if more than transitory is significant of intracranial hemorrhage or brain damage. Inequality of reflexes; increased systolic pressure; positive Babinski sign; possible cerebrospinal rhinorrhea; inequality of the pupils; Battle's sign—ecchymosis about the mastoid and along the course of the postauricular artery.

Herrmann's[208] article deals mainly with the treatment of recent injuries involving the maxillary sinus, although some consideration is given to cases where the ethmoids and frontals are involved. He makes a point of preserving all bone fragments that are still attached to the soft tissues and of instituting drainage via the inferior meatus. If the root of the nose is forced backward by the trauma, it is more than likely that the ethmoids are involved and possibly the cribriform plate. He therefore advises that in such cases the area be thoroughly explored and the ethmoids cleaned out. Cases where the orbital contents and the endocranium are concerned must have the combined judgment of the neurosurgeon, the ophthalmologist, and the rhinologist.

Hematoma of the orbit can rapidly lead to blindness through compression of the central artery, unless the cavity is decompressed by removal of the floor or mesial wall.

The author likes to use a stuffed finger cot or portion of a rubber glove for support in the antrum and for packing and drainage.

Failure to take adequate x-ray pictures in all cases may spell disaster for the patient. This, of course, is axiomatic.

Gottlieb[209] reports three cases of fracture of the superior maxilla in which facial emphysema appeared suddenly after the patient had blown the nose. In all of the cases it was possible to demonstrate the crack in the bony wall of the sinus. They all recovered within a short time, being given antibiotics and cautioned against blowing the nose for three weeks.

The case reported by Nyiry[210] was a man aged 33 who was thrown from his bicycle, landing on his forehead. X-ray revealed a depressed fracture of the left frontal bone and a collection of air in the anterior fossa measuring 3 cm. in diameter. It was assumed that the air gained entry through the ethmoid labyrinth, although it could not be demonstrated in the films.

The patient improved under antibiotic therapy, and the air disappeared within three months. No surgery was performed.

Rastopchin's case[211] was a young man who was attacked and struck over the forehead with a knife. The wound was sutured but failed to heal properly. The patient complained of headache and nausea with some fever. About two months later an x-ray picture revealed the knife blade deeply imbedded, and when the frontal area was opened, considerable pus was evacuated and the blade extracted. However, it appeared to have penetrated into the brain. Proper drainage and antibiotics soon effected a cure without any after-effects.

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REFERENCES

1. Liss, L.: The Histology of the Human Olfactory Bulb and the Extracerebral Part of the Tract, Ann. Otol. Rhin. & Laryng. 65:680 (Sept.) 1956.

2. Liss, L.: Astroglia and Perivascular Structures of the Human Olfactory Bulb: A Study with Silver-Carbonate, Ann. Otol. Rhin. & Laryng. 65:937 (Dec.) 1956.

3. Shapiro, M.: Morphology of the Nerve Apparatus of the Mucous Membrane of the Frontal Sinuses, Vestnik. oto-rino-laring. 18:33 (Jan.-Feb.) 1956.

4. Funaro, C., and Leonardi, L.: I seni frontali ed il metopismo nei deficenti psichici, Lattante 27: 65 (Feb.) 1956.

5. Toni, G., and Trombetta, N.: Su alcuni dati di mizurazioni del forame supraorbitario dell'uomo, Boll. soc. ital. biol. sper. 31:453 (May) 1955.

6. Toni, G., and Sanesi, L.: Considerazioni di ordine statistico su alcune mizurazuoni del forame intraorbitavio nell'uomo, Boll. soc. ital. biol. sper. 31:451 (May) 1955.

7. Radoïévitch, S., and Joyanovitch: La morphologie du canal vidien et ses rapports avec les sinus paranasaux chez l'homme adulte et l'enfant, Rev. Laryng. 76:481 (Sept.-Oct.) 1955.

8. Riesenfeld, A.: Multiple Infraorbital, Ethmoidal and Mental Foramina in the Races of Man, Am. J. Phys. Anthropol. 14:85 (March) 1956.

9. Radoïévitch, S., and Joyanovitch, S.: Le pneumatisation de la paroi externe de la cavite orbitaire par les sinus paranasaux, Rev. Laryng. 76:493 (Sept.-Oct.) 1955.

10. Ray, C. D.: Configuration and Lateral Closure of the Superior Orbital Fissure, Am. J. Phys. Anthropol. 13:309 (June) 1955.

11. Schimizzi, M.: La spongiosi dei seni frontali, Arch. radiol. 30:349, 1955.

12. Di Blasi, A.: Sintisi palato-faringea e sviluppo dei seni paranasali, Boll. mal. orecchio gola, naso. 73:607, 1955.

13. Stoksted, P.: Permeability of the Nasal Passages Determined by Anterior Rhinoscopy, Acta oto-laryng. 46:64 (Jan.-Feb.) 1956.

14. Ingelstedt, S.: Studies on the Conditioning of Air in the Respiratory Tract, Acta oto-laryng., Supp. 131, 1956.

15. von Hesse, W.: Klinik der Olfaktometrie und olfaktometrische Untersuchungen von stirnbeinhöhlenoperierten, Ztschr. Laryng. Rhin. Otol. 34: 793 (Dec.) 1955.

16. Guild, A. A.: Olfactory Acuity in Normal and Obese Human Subjects: Diurnal Variations and the Effect to D-Amphetamine Sulfate, J. Laryng. & Otol. 70:408 (July) 1956.

17. Ancetti, A.: Il comportamento dell'acido timo e ribonucleico nelle cellule della mucosa nasale in varie condizioni fisiopatologiche, Oto-rino-laring. ital. 23:303, 1955.

18. Berendt, R. E., and Nungester, W. J.: The Effect of Nasal Secretions upon Human Serum, J. Infect. Dis. 98:223 (May-June) 1956.

19. Dieckmann, H.: Die klinischen Bedeutung der Perisinusitis, Nervenarzt 26:436 (Oct. 20) 1955.

20. Stevenson, H. N.: Gross Pathology of Sinus Discharge, A.M.A. Arch. Otolaryng. 63:124 (Feb.) 1956.

21. Manzanete, J. R.: Neuvas orientaciones etiopatologicas de los procesos disreaction focal nasosinusal, Rev. espan oto-neuro-oftal. 15:306 (May-June) 1956.

22. Anderson, J. H., and Rubin, W.: The Diagnosis and Treatment of Upper Respiratory Symptoms Produced by Increased Viscosity of Mucous and Dryness of the Mucous Membranes, Laryngoscope 66:85 (Jan.) 1956.

23. Albernaz, P., and DaSilva, M. D.: Diagnostico radiografico das etmoid, Rev. Brasil oto-rino-laring. 23:43 (March-April) 1955.

24. Anspach, K. F.: Lokalisation von Fremdkorpern und verlagerten Zahnen, Zahn- Mund- u Kieferh. 16:81, 1955.

25. Meuschke, J.: Die Röntgendurchleuchtung der Nebenhöhlen als Teil der Herddiagnostik, Munchen. med. Wchnschr. 98:369 (March 16) 1956.

26. Pijade, R., and Novak, J.: Our Experience in the Tomography of Maxillary Sinuses, Srpski arh. celok lek. 84:460 (April) 1956.

27. Lyons, N. J., and Denny, J. C.: Projections for Radiography of the Paranasal Sinuses, X-Ray Technician 27:1 (July) 1955.

28. D'Ajutolo, F.: Sulla tecnica del metodo di spostamento di Proetz, Oto-rino-laring. ital. 23: 415, 1955.

29. Petersen, E. E.: Roentgenologic Interpretation of Anatomic Lines of the Maxillary Sinus, J. Am. Dent. A. 53:165 (Aug.) 1956.

30. Bouchet and Dulac, G.: Sur la radiographie de l'ethmoide en position de Rhese et la pratique des incidences angulaires grâce aux appareilleges tournant autour d'un point de centrage fixe, Ann. oto-laryng. 72:824, 1955.

31. Bader, W.; Masing, H.; Meyer, I., and Werner, K.: Die Übersichtstomographie in der Horizontalebene zur Schädelbasis und Nebenhöhlendiagnostik, Ztschr. Laryng. Rhin. Otol. 35: 336 (May) 1956.

32. Lanzendorfer, W.: Der äthertest, eine neue Methode zur diagnostischen Differenzierung von Nebenhöhlenaffektion und Trigeminusneuralgie, Med. Klin. 51:1142 (July 6) 1956.

33. Hohlbrugger, H.: Zur ätiologie und klinik orogener, rhinogener, nichteitriger endokrannieller Komplikationen, Monatsschr. Ohrenh. 90:174 (June) 1956.

34. Kaplan, S.: Cerebrospinal Rhinorrhoea—Transorbital Surgical Management, Eye, Ear, Nose & Throat Month. 35:251 (April) 1956.

35. Sen Gupta, S. K.: A Case of Cerebrospinal Rhinorrhoea, J. Laryng. & Otol. 70:428 (July) 1956.

36. Edling, N. P. G.: The Roentgenological Findings of the Nasal Sinuses in Uveitis, Acta ophth. 33:627, 1955.

37. Vogel, K.: Orbitale Komplikationen bei Nasen- und Nebenhöhlenerkrankungen, Med. Klin. 50:2025 (Dec. 2) 1955.

38. Bonnet, P., and Bonnet, L.: Le syndrome du trou déchiré antérieur, symptomatique de l'anévrisme de la carotide intracranienne, Rev. oto-neuro-ophth. 27:22, 1955.

39. Bonnet, M. P.: Epistaxis mortelle par rupture traumatique de la carotide interne dans le sinus sphénoidal, Rev. oto-neuro-ophth. 27:25, 1955.

40. Mazzi, L.: L'orbitografia in un caso di esoftalmo da iperpneumatizzazione delle cellule etmoidali, Gior. psichiat. e neuropat. 84:21, 1956.

41. Paufique, L., and Audibert, J.: A propos de deux cas de neuro-papillite d'origine sinusienne, Bull. Soc. opht. France p. 721, Nov., 1955.

42. Curković, M.: Rinogeni kasalj., Liječ. vjes. 77:387 (Aug.-Sept.) 1955. (English abstract.)

43. Boček, J.: Sinobronchitis, Česk. Otolaryng. 5:152 (May) 1956. (Author's English abstract.)

44. Siegel, S.; Goldman, J. L., and Arnold, L. M.: Sinus Disease, Bacterial Allergy, and Bronchial Disease, A.M.A. Arch. Int. Med. 97:431 (April) 1956.

45. Grove, R. C.: Surgical Treatment of Sinusitis Associated with Asthma, New York J. Med. 56:726 (March) 1956.

46. Clerici, E., and Vago, A.: L'osteomielite dell'osso frontale, Arch. ital. otol. 66:688 (Sept.-Oct.) 1955.

47. Nash, C. S.: Osteomyelitis of the Frontal Bone, A.M.A. Arch. Otolaryng. 64:108 (Aug.) 1956.

48. Ninger, F.: Osteomyelitis celni kosti nosniko puvodu, Casop. lék. česk 94:1279 (Nov. 25) 1955.

49. Hertle, W.: Die Schädelosteomyelitis und das Eosinophile (Knochen) Granulom in der Hals-Nasen-Ohren-Heilkunde, Ztschr. Laryng. Rhin. Otol. 35:44 (Jan.) 1956.

50. Uthgenannt, H., and Klose, H. H.: Die Nasennebenhöhlen und ihre Bedeutung fur die innere Medizin, Ergebn. inn. Med. u. Kinderh. 6:374, 1955.

51. Kaiser-Meinhardt, I.: Über die Nebenhöhlenentzündingen der Kinder, HNO 5:226 (Jan. 31) 1956.

52. Schlander, E., and Neuberger, F.: Die Behinderung der Nasenatmung und ihre Ursachen im Säugslings und Kindesalter, Monatsschr. Ohrenh. 89:191 (July-Sept.) 1955.

53. Keiser, D. P.: Acute sinusitis bij kinderen, Geneesk. gids 431:134 (March 29) 1956.

54. Kos, C. M.: Relation of Adenoids and Sinusitis to Otologic Disease, Texas J. Med. 52: 352 (June) 1956.

55. Van Caneghem, D.: La toux de barrage dans la sinusite chronique de l'enfance, Acta oto-rhino-laryng. belg. 9:405 (Nov.) 1955.

56. Maspétiol, R.; Grenet, J.; Chauvet, J., and Desbois, J.: L'hydrocortisone dans le traitement de la sinusite maxillaire chronique de l'enfant, Presse méd. 64:530 (March 21) 1956.

57. King, N. D.: The Common Cold and Sinusitis, J. Am. Osteopath. A. 55:275 (Dec.) 1955.

58. Scholbel, H.: Kieferhöhlenbehandlung mit Dauerkathetern, Monatschr. Ohrenh. 89:212 (July-Sept.) 1955.

59. Petrocini, S., and Bullio, D.: Su cinque casi di osteomielite del mascellare superiore nel lattante, Minerva pediat. 8:662 (April 28) 1956.

60. Vogt, U.: Moderne Chemotherapie und Oberkieferosteomyelitis im Säuglings- und Kindesalter, H.N.O. 5:275 (March) 1956.

61. Roy: L'allergie naso-sinusienne de l'enfant, Concours méd. 78:1323 (March) 1956.

62. Takashi, M.: Carcinoma of Paranasal Sinuses: Its Histogenesis and Classification, Am. J. Path. 32:501 (May-June) 1956.

63. Hendrick, J. W.: Treatment of Cancer of the Nasal Cavity and Paranasal Sinuses, Surg. Gynec. & Obst. 102:322 (March) 1956.

64. Turnbull, F. M., Jr., and Hara, H. J.: Carcinoma of the Paranasal Sinuses and the Nasal Cavities, Tr. Pacific Coast Oto-Ophth. Soc. 36:311, 1955.

65. Pfander, F.: Beobachtungen und Behandlungsergebnisse bei 102 malignen Tumoren der Nase und Nebenhöhlen, Arch. Ohren- Nasen- u. Kehlkopfh. 168:133 (Aug. 20) 1955.

66. Brun, H.: Die malignen Tumoren der Nasennebenhöhlen, des Oberkiefers und des Unterkiefers, Pract. oto-rhino-laryng. 18:171 (May) 1956.

67. Vathy, I.: Malignant Tumors of Nose and Sinuses: 50 Cases, Orv. hetil. 96:708 (June 26) 1955.

68. Skolnik, E. M.; Fornatto, E. J., and Heydemann, J.: Osteogenic Sarcoma of the Skull Following Irradiation, Ann. Otol. Rhin. & Laryng. 65:915 (Dec.) 1956.

69. Terracol, V., and Camps, F.: Le cancer du sinus frontal, Ann. d'oto-laryng. 73:396 (June) 1956.

70. Spaulding, R. L.: Ameloblastoma of the Maxilla, Oral Surg. 9:509 (May) 1956.

71. Gordon, I. R. S.: The Radiology of Malignant Tumours of the Nose, J. Laryng. & Otol. 69:786 (Dec.) 1955.

72. Rainer, E. H., and Burne, J. C.: Fronto-Ethmoidal Carcinoma, J. Laryng. & Otol. 70:420 (July) 1956.

73. Sciarra, P. A., and Hallberg, O. E.: Primary Squamous Cell Carcinoma of the Frontal

Sinus, Ann. Otol. Rhin. & Laryng. 65:225 (March) 1956.

74. Bartalena, G.: Sopra un caso di cancro laringeo e di cancro etmoidale con metastasi sottocutanee, Boll. mal. orrecchio, gola, naso 74: 118 (March-April) 1956.

75. Fojtik, M.: Cancer of the Upper Jaw with Description of a Case, Cesk. stomatol. No. 4-5, p. 154 (July) 1955.

76. Ratko, A. L.: Tumors of the Nose and Paranasal Sinuses, J. Internat. Coll. Surgeons 25: 777 (June) 1956.

77. Harman, R. R. M.; Kodicek, L., and Pinniger, J. L.: Malignant Lymphomas of the Nose and Throat, J. Laryng. & Otol. 70:377 (July) 1956.

78. Marques, P.; Birague, C., and Hénous, G.: Metastases cutanées d'un épithelioma du maxillaire supérieur, Bull. A. franç. l'étude cancer 42:389, 1955.

79. Christansen, G. W.: Carcinoma of Right Maxilla, Clear Cell Type, Oral Surg. 9:589 (June) 1956.

80. Gros, C. M.; Frühling, L., and Keiling, R.: Injection de thorotrast dans le sinus maxillaire: 15 ans après: apparition d'un epithelioma malpighien, Bull. A. franç. l'étude cancer 42:556, 1955.

81. Waltner, J. G., and Fetton, R. H.: Anesthesia of the Cheek, an Early Sign of Carcinoma of the Maxillary Sinus, Ann. Otol. Rhin. & Laryng. 65:955 (Dec.) 1956.

82. Lawson, L. T.: Intranasal Chondrosarcoma, A.M.A. Arch. Otolaryng. 64:331 (Oct.) 1956.

83. Pellegrini, A.: I tumori dell'etmoide, Arch. ital. Otol., Supp. 24, 1955.

84. Takashi, M.: Uncommon Tumors Arising from the Ethmoidal Sinus and the Nasopharynx, A.M.A. Arch. Otolaryng. 64:36 (July) 1956.

85. Ye, K. C.; Robinson, D. W., and Hamilton, T. R.: Fatal Necrotizing Infection of the Face, Plast. & Reconstr. Surg. 17:314 (April) 1956.

86. Paterson, W.: Malignant Granuloma of the Nose, Acta oto-laryng. 46:43 (Jan.-Feb.) 1956.

87. Melnikov, R. A.: Giant Cell Tumor of Unusual Location, Vopr. Onkol. 1:116-117, 1955.

88. Prietzel, F.: Pyomukozele der linken Stirnhöhle mit Spontandurchbruch an der Stirnhöhlenvorderwand nach endonasaler Stirnhöhlenoperation vor 26 Jahren, Monatsschr. Ohrenh. 90:142 (June) 1956.

89. Meunier, J. P.; Benois, J.; Demesse, J., and Meunier, J. L.: Un diagnostic parfois difficile: celui de mucocèle fronto-ethmoïdale, Bull. Soc. méd. mil. franç. 50:60 (March) 1956.

90. Kassay, D., and Kolba, V.: A nyalkahartya megtartasaval operalt ormmellekuregi mucocelek, Arvo. hetil. 41:1140 (Oct. 9) 1955.

91. Lovi, M.: Mucocele of Frontal Sinus, Szemészet 91:137 (Aug.) 1954.

92. Laszka, B.: A Case of a Giant Mucocele of the Frontal Sinus and the Ethmoidal Labyrinth, Otolaryng. polska 9:63, 1956. (English abstract.)

93. Andrew, J.: Osteomata of the Paranasal Sinuses: A Report of 5 Cases with Special Reference to Their Treatment, Brit. J. Surg. 43: 489 (March) 1956.

94. Sasso, B., and Smolčić, V.: Osteoma orbitae et sinus frontalis, Med. arh. 9:113 (Sept.-Oct.) 1955.

95. Perucci, U., and Testani, F.: Brevi considerazioni sugli osteomi di un decennio nella Clinica O. R. L. dell' Università di Modena, Oto-rino-laring. ital. 23:487, 1955.

96. Portela de Villasante, J.: A propósito de un caso de osteoma frontoethmoidal, Acta oto-rino-laring. ibero-amer. 7:143, 1956.

97. Ceypek, T., and Madrożkiewicz, M.: Olbrzymi kostniak zatoki czołowej, Otolaryng. polska 9:335, 1955.

98. Kopovoi, A. H.: Ob osteomakh pridatochnykh pazukh nosa, Vestnik. oto-rino-laring. 18: 48 (Jan.-Feb.) 1956.

99. Leroux, L.: Ostéome naso-sphénoïdal, Ann. oto-laryng. 73:310 (May) 1956.

100. Sensini, L., and di Brino, M.: Osservazioni su di un caso di osteoma ancora iniziale del seno frontale, Atti Accad. Fisiocrit. Siena, sez. med. fis. 2:369, 1955.

101. Shaw, H.: Ethmoidal Osteoma in Association with Intracranial Pneumatocele, J. Laryng. & Otol. 70:242 (April) 1956.

102. Lederer, F. L.; Smitman, M. F.; Skolnik, E. E., and Soboroff, B. J.: Tumors of the Nasal Cavity, Laryngoscope 67:592 (June) 1957.

103. Clerici, E.; Leonardelli, G. B., and Pizzetti, F.: Patogenesi, istopatologia, istochemica e clinica delle rino-sinusiti iperplastiche polipoidi, Arch. ital. otol. 66:849 (Nov.-Dec.) 1955.

104. Fox, S. L.: Nasal Polyps in Relation to Nasal Sinusitis, Eye, Ear, Nose & Throat Month. 35:492 (Aug.) 1956.

105. Van Alyea, O. E.: Management of Non-Malignant Growths in the Maxillary Sinus, Ann. Otol. Rhin. & Laryng. 65:714 (Sept.) 1956.

106. Galioto, G. B.: Notevole deformazione della piramide nasale secondaria a poliposi etmoidale, Minerva otorinolaring. 5:154 (May-June) 1955.

107. Weille, F. L., and Gold, R. S.: The Virus Theory of Nasal Polyp Etiology and Its Practical Application, Ann. Otol. Rhin. & Laryng. 65:443 (June) 1956.

108. Feingold, M.: Myxofibroma of the Maxilla, Oral Surg. 9:826 (Aug.) 1956.

109. Leroux, L.: Un cas de fibrome envahissant les sinus maxillaire, ethmoïdal et sphenoïdal, Ann. oto-laryng. 73:311 (May) 1956.

110. Ries Centeno, R.; Costa Vidán, D., and Roca, J. A.: Quiste dentigero originado a raiz de

un molar, supernumario alojado dentro del seno maxilar, Rev. méd. hosp. españ. 25:19 (Jan.-June) 1955.

111. Lishchinski, G. E.: Two Observations on Cystic Dilatation of the Maxillary Sinus, Vestnik oto-rino-laring. 34:73 (July-Aug.) 1955.

112. Kruchinina, I. L.: Cementoma of the Accessory Sinuses of the Nose, Vestnik oto-rino-laring. 34:69 (July-Aug.) 1955.

113. Olven, S., and Stahle, J.: Odontoma of the Upper Jaw: Report of a Case, Acta Soc. med. upsal. 61:86, 1956.

114. Pistolesi, G. F., and Ruffato, C.: Cisti epidermoide dell'osso frontale, Rive. anat. pat. e onc. 8:1193 (Sept.) 1954.

115. Toussaint, D.: A propos d'un cas de tumeur de la grande aile du sphénoide, Acta neurol. et psychiat. belge 55:524 (June) 1955.

116. Filgueiras, J., and Bevilacqua, S.: Infected Globulomaxillary Cyst, Oral Surg. 9:505 (May) 1956.

117. Simonetta, B.: Condrosarcoma del mascellare associato a Paget? Boll. mal. orecchio gola, naso 74:109 (March-April) 1956.

118. Bandiera, D. C.; Torloni, H., and Abrão, A.: Granuloma eosinófilo do osso, Rev. paul. med. 47:361 (Sept.) 1955.

119. Hernandez, A.; Schwartman, J., and Silva, A. D.: Indicaciones del tretamiento quirurgico de las sinusitis, Semana méd. 108:470 (April 12) 1956.

120. Rauch, S.: Zur Nebenhöhlenradicaloperation nach De Lima, Arch. Ohren- Nasen- u. Kehlkopfh. 168:279 (Dec. 29) 1955.

121. Sokčić, A.: Povrede frontalnih: etmoidnih sinusa, Voj. san. pregl. 11:510 (Nov.-Dec.) 1954.

122. Simpson, W. L.: The Nasal Sinuses: Present Status of Surgical Management, Eye, Ear, Nose & Throat Month. 35:505 (Aug.) 1956.

123. McAuliffe, G. W.: The Maxillary Sinuses: Their Reaction to Infection and to Surgical Intervention, Eye, Ear, Nose & Throat Month. 35:496 (Aug.) 1956.

124. Diamant, M., and Ottoson, B.-G.: Radical Pansinus Operations in Cases of Nasal Polyps, A.M.A. Arch. Otolaryng. 65:449 (May) 1957.

125. Rouis, B. J.: Conservative Sinus Surgery, J. Internat. Coll. Surgeons 25:608 (May) 1956.

126. Frazell, E. L.: The Surgical Treatment of Cancer of the Paranasal Sinuses, Tr. Am. Laryng. Rhin. Otol. Soc. p. 351, 1955.

127. Laskin, D. M., and Robinson, I. B.: Surgical Closure of the Oroantral Fistula, J. Oral Surg. 14:201 (July) 1956.

128. Wurmová, L.: A Contribution to the Treatment of Oroantral Communications, Československ. stomatol., No. 4-5, p. 176, 1955. (English summary.)

129. Mandic, D.: Treatment of Oro-Maxillary Fistulae of Dental Origin, Srpski arh. celok. lek. 84:208 (Feb.) 1956.

130. Bagozzi, I. C.: Chiusura di fistole posttraumatiche del seno mascellare o del palato mediante rotazione di lembi cutanei o fibromucosi e contemporanei trapianti liberi di cute, Osp. maggiore 43:356 (Aug.) 1955.

131. Norman, W. D.: Oro-Antral Fistula: A One-Stage Closure, Texas J. Med. 35:336 (May) 1956.

132. Montandon, A.: Démonstrations cliniques: Sinusitie frontale récidivante; Grette cutanée; Tumeur emuahissante du sphenoide, Pract. oto-rhino-laryng. 17:408, 1955.

133. Tremble, G. E.: Frontal Sinus Drainage, A.M.A. Arch. Otolaryng. 63:254 (March) 1956.

134. Goufas, G., and Gominatos, C.: Sinusite frontale bilaterale chronique réchauffée, Ann. oto-laryng. 73:70 (Jan.-Feb.) 1956.

135. Jakobi, H.: Ein Beitrag zur plastischen Duradeckung im Bereiche der Lamina cribriformis, Ztschr. Laryng. Rhin. Otol. 34:480 (July) 1955.

136. Boyden, G. L.: An Otolaryngologic Approach to Malignant Exophthalmos, Laryngoscope 66:623 (June) 1956.

137. Walsh, T. S., and Ogura, H. J.: Transantral Orbital Decompression for Malignant Exophthalmos, Laryngoscope 67:544 (June) 1957.

138. Dietrich, H.: Verbesserung der Herstellung von Epithesen durch neue Werkstoffe, HNO 5:316 (May) 1956.

139. Moreau, A., and Caux, M.: Ethmoïdectomie ou curettage ethmoïdal, Laval Med. 21:20 (Jan.) 1956.

140. Pagnini, G., and Comoretto, R.: Risultati a distanza di tempo in 166 casi di sinusiti etmoidomascellari operati secondo Pietrantoni-De Lima, Friuli med. 10:928 (Nov.-Dec.) 1955.

141. Kruisbrink, J. J.: Prothese na totale resectie van de bovenkaak, Tijdschr. tandheelk. 62:765 (Nov.) 1955.

142. Turletti-Tola, A.: La terapia biofisica Niccolini in alcuni casi di sinusite frontale cronica, Gazz. med. ital. 114:172 (Aug.) 1955.

143. Clerici, E.; Tesco, L., and Massara, G.: Risultati terapeutici e modificazioni istopatologiche della mucosa in seguito ad iniezioni sottomucose endonasali di cortisone ed idrocortisone nelle rinopatie allergiche, Arch. ital. otol. 66:745 (Sept.-Oct.) 1955.

144. Dreyfus, S.: Über Technik und Wirkung der Inhalation mit schwefelwasserstoffhaltigen Mineralquellen, Schweiz. med. Wchnschr. 86:488 (May 12) 1956.

145. Moser, F.: Konservative und operative Therapie der entzündlichen Nasennebenhöhlenaffektionen, Deutsches med. J. 7:343 (May 23) 1956.

146. Liener, A.: Nach antibiotischer Behandlung aufgetretene Aspergillose der Siebbeinzellen mit sekundärer Meningitis aspergillina und begleitendem mykotischem Pyocephalus, Monatsschr. Ohrenh. 90:138 (June) 1956.

147. Hussarek, M.: Viruserkrankungen und ihre Merkmale im Hals-Nasen-Ohren-Bereich, Arch. Ohren- Nasen- u. Kehlkopfh. 167:325, 1955.

148. Van Alyea, O. E.: Recent Trends in the Non-Surgical Management of Nasal Sinusitis, Eye, Ear, Nose & Throat Month. 35:489 (Aug.) 1956.

149. Lumio, J. S.: On the Treatment of Maxillary Sinusitis with Oxytetracycline and Penicillin, Antibiotic Med. 2:52 (Jan.) 1956.

150. Goodyear, H. M.: Chronic Maxillary Sinusitis: Evaluation of Available Therapeutic Procedures, Eye, Ear, Nose & Throat Month. 35:503 (Aug.) 1956.

151. Schöler, W.: Dauererfolge bei chronischen Kieferhöhlenentzündungen durch gezielte chemotherapeutische Lokalbehandlung, Monatsschr. Ohrenh. 90:87 (April) 1956.

152. Croce, C.: L'associazione cloramfenicolo-tripsina nel trattamento locale delle flogosi croniche delle cavità sinusali e dell'orecchio, Arch. ital. otol. 67:452 (May-June) 1956.

153. Mills, A. E.: Staphylococcus Bacteriophage Lysate Aerosol Therapy of Sinusitis, Laryngoscope 66:846 (July) 1956.

154. Miller, J. M.; Surmonte, J. A.; Ginsburg, M., and Abloudi, F. B.: Treatment of Acute Sinusitis with Penicillin and the Intramuscular Use of Streptokinase, Laryngoscope 66:143 (Feb.) 1956.

155. Terracol, J.; Guerrier, T., and Camps, F.: L'instillation de cortisone dans les sinusites maxillaraires dites allergiques, Ann. oto-laryng. 73:502 (June) 1956.

156. Lemaire, J.: Methode de Proetz et thermalisme, Acta oto-rino-laring. iber.-am. 7:501, 1956.

157. Fornatto, E. J.; Skolnik, E. M., and Trumpton, R. H.: The Triad of Kartagener: Relation of Upper to Lower Respiratory Pathology, Laryngoscope 66:1202 (Sept.) 1956.

158. Nichamin, S. J.: Kartagener's Syndrome in a Newborn Infant, J. A. M. A. 161:966 (July 7) 1956.

159. Parrella, M., and Rescigno, B.: Su di un caso clinico di "Sindrome di Kartagener," Arch. fisiol. 10:1067 (Dec.) 1955.

160. Kartagener, M., and Mully, K.: Bronchiectasien bei Situs viscerum inversus, Schweiz. Ztschr. Tuberk. 13:166, 1956.

161. Von Finkler, E.: Kartagener's Syndrom, Schweiz. med. Wchnschr. 86:631 (May 26) 1956.

162. Northrup, D. W., and Van Lierle, E. J.: The Electrocardiogram in Situs Inversus (Case Report), West Virginia M. J. 52:169 (June) 1956.

163. Proba, B.: Przypadek zespołu Kartagenera, Polskie arch. med. wew. 25:995, 1955.

164. Liwszyc, S., and Surdacki, A.: Przypadek zespołu Kartagenera, Polski tygod. lek. 11:541 (March 19) 1956.

165. Friel, K. H.: Situs inversus viscerum und Kartagener'scher Symptomenkomplex (Studie an 20 Fällen), Deutsches med. J. 6:600 (Nov. 15) 1955.

166. Grange, Cazenave, Weis: Un cas de syndrome de Kartagener, Rev. laryng. 77:175 (Jan.-Feb.) 1956.

167. Frank, N., and Desai, A. S.: Kartagener's Triad, Med. Times 84:745 (July) 1956.

168. Moore, T. C., and Silver, R. A.: Kartagener's Syndrome: Report of a Case Treated by Middle Lobe Lobectomy, Am. Surgeon 22:595 (June) 1956.

169. Samsoe-Jensen, T.: Kartagener's Triad: Situs Inversus, Bronchiectasis and Sinusitis: Report of a Case, Acta paediat. 45:433 (July) 1956.

170. Deutsche, O. L.: Kartagener's Triad (Situs Inversus, Bronchiectasis and Sinusitis): Report of a Case, Dis. Chest 30:231 (Aug.) 1956.

171. Cordeiro, R.: Sindrome de Kartagener, J. méd. Pôrto 30:121 (May 19) 1956.

172. Martinez, Fernández, J.: Transposición total de vísceras y otras malformaciones, Acta pediát. español. 13:427 (June) 1955.

173. Chenebault, S., and Le Pape, J.: Sur un cas de syndrome de Kartagener associé à des anomalies costales et à une tuberculose pulmonaire, Maroc méd. 35:45 (Jan.) 1956.

Maxillary—Dental

174. Mašura, S.: Prisperok ku kasuistike highmoritid, Lek. obzor. 3:294, 1954.

175. Livingstone, G.: Sarcoidosis of Maxillary Antrum, J. Laryng. & Otol. 70:426 (July) 1956.

176. Lombardo, L.: La sinusite mascellare caseosa, Arch. ital. otol. 66:393 (May-June) 1955.

177. Anderson, H. C., and Stenderup, A.: Aspergillosis of the Maxillary Sinus, Acta oto-laryng. 46:471 (Nov.-Dec.) 1956.

178. Bompoint, J., and Trombetti, N.: Sinusite maxillaire nécrotique par dent ectopique, Maroc méd. 35:233 (March) 1956.

179. Centeno, G. A.: Casos de cirugia, Rev. A. Odont. Argent. 43:299 (Aug.) 1956.

180. Wade, G. W.: Alleviation of Subacute Maxillary Sinusitis, Oral Surg. 9:715 (July) 1956.

181. Haberman, G.: Lebensbedrohende Entzündungen im retromaxillaren Raum, HNO. 6:346 (May 8) 1956.

Headache—Neuralgia

182. Turnley, W. H.: Hemicrania—or One-Sided Sphenopalatine Ethmoid Headache, Laryngoscope 66:582 (May) 1956.

183. Canciullo, D., and Motta, G.: Neuralgia sopraorbitarie e sinusiti frontali, Oto-rino-laring. ital. 24:241, 1956.

184. Couch, C. D., Jr.: Facial Pain, J. Oral Surg. 14:216 (July) 1956.

185. Piñeiro, J. M.: Sinusitis aguda y jaqueca, Rev. méd. Cuba 67:331 (April) 1956.

Miscellaneous

186. Treatment of the Nose and Accessory Sinuses in Surgery, Seminar Internat. 4:18, 1955.

187. Natali, R.: Diagnostic des sinusites aigues, Arch. méd. 36:1401 (Dec.) 1955.

188. Terracol, J.: L'infection dite focale d'origine sinusienne, Ann. oto-laryng. 73:484 (June) 1956.

189. Whitaker, J. G.: Capilares do sangue e otorrinolaringologia: IV. Infecções focais; diagnostico e localização por sintomas subjectivos, Rev. brasil. oto-rino-laring. 23:140 (July-Aug.) 1955.

190. Thoma, K. H.: Differential Diagnosis of Fibrous Dysplasia and Fibro-Osseous Neoplastic Lesions of the Jaws and Their Treatment, J. Oral Surg. 14:185 (July) 1956.

191. Rolanson, M., and Fogel, L. J.: Fibrous Dysplasia of the Maxilla, Leontiasis Ossea Type, Oral Surg. 9:817 (Aug.) 1956.

192. Stamm, C.: Fibrous Dysplasia of Facial Bones, A.M.A. Arch. Otolaryng. 64:293 (Oct.) 1956.

193. Bauer, P., and Sutliffe Kerr, A.: Fibrous Dysplasia of the Skull, J. Laryng. & Otol. 70:44 (Jan.) 1956.

194. Winslow, M. B.: Paget's Disease: Report of a Case, J. Oral Surg. 13:336 (Oct.) 1955.

195. Guerrier, Y.: Alterations de l'articulation temporomaxillaire au cours du syndrome l'ethmoidoantrite, bronchiectasie, bouchon epidermique, Ann. oto-laryng. 73:505 (June) 1956.

196. Cody, C. C., III: An Unusual Case of Sphenoid Abscess, A.M.A. Arch. Otolaryng. 63:190 (Feb.) 1956.

197. Gentile, C.: Su di un caso di colesteatoma fronto-orbitario, Riv. pat. nerv. 76:978, 1955.

198. Surber, J. R.: Chronic Bacterial Allergy of the Perinasal Sinuses, A.M.A. Arch. Otolaryng. 64:351 (Nov.) 1956.

199. Silcox, L. E.: Allergic Sinusitis, J. Internat. Coll. Surgeons 25:362 (March) 1956.

200. Schnurbusch, F.: Über besondere Erscheinungsformen des Pemphigus Vulgaris in der Hals-Nasen-Ohrenheilkunde, Ztschr. Laryng. Rhin. Otol. 34:520 (Aug.) 1955.

201. Mange, R.: Diphterie sinusale, sinusite diphterique et porteurs de germes, Pract. oto-rhino-laryng. 17:351, 1955.

202. Pennington, C. L.: Paranasal Sinus Changes in Fibrocystic Disease of the Pancreas, A.M.A. Arch. Otolaryng. 63:576 (June) 1956.

203. Kislova, L. N.: Bilateral Cystic Dilatation of the Ethmoid Labyrinth in an Adolescent, Vestnik oto-rino-laring. 18:70-71 (Jan.-Feb.) 1956.

204. Withalm, A.: Zur primären Versorgung von Stirnhöhlen verletzungen, Monatsschr. Ohrenh. 89:206 (July-Sept.) 1955.

205. Sokčič, A.: Injuries of Frontal and Ethmoid Sinuses, Voj. san. pregl. 11:510 (Nov.-Dec.) 1954.

206. Shands, R. E.: The Use of a Transmaxillary Bar in Fractures of the Maxilla, Am.

208. Herrmann, A.: Versorgung der frischen verletzung Nasennebenhöhlen Gebiet, Monatsschr. Unfallh. 52:150, 1956.

209. Gottlieb, O.: Subcutaneous Emphysema in Fracture of the Facial Bones, Oral Surg. 9:501 (May) 1956.

210. Nyiry, Z.: Fracture of the Anterior Fossa with Pneumocencephalus, Ful-orr-gegyogy, No. 2,

nosis of Maxillary Fractures, J. Oral Surg. 15: 137 (April) 1956.

207. Lesnev, T. A.: Considerations in Diag-

J. Surg. 91:100 (Jan.) 1956

p. 92, May, 1956.

211. Rastopchen, N. D.: Symptomatic Course of Abscess Consecutive to Injury of the Frontal Sinus, Vestnik oto-rino-laring. 34:71 (July-Aug.) 1955.

Society Transactions

AMERICAN OTOLARYNGOLOGICAL ASSOCIATION

LeRoy A. Schall, M.D., President
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Seventy-Eighth Annual Meeting, Washington, D. C., May 3, 1957

Some Unsolved Problems of Aviation Otolaryngology.

Col. Paul A. Campbell (MC), U. S. A. F.

Among the problems which the Air Force is seeking to solve are noise production, noise sources, and the media through which the energy is transmitted. Methods of cancellation of wave sources and conversion of noise into useful energy have been the subject of considerable research. Future problems have to deal with the behavior and the reactions of the human being in a gravity-free field such as envisioned when space travel becomes a reality. When the vestibular apparatus and the kinesthetic sense are inoperative through elimination of the gravity vector, what will be the effect on orientation? Another problem for the future is the construction of a completely sealed cabin in which pressurized air and oxygen have to be provided for really high altitudes and means devised for utilizing exhaled products so as to reduce the weight of the vehicle.

Pressurization of cabins has thus far reduced the incidence of ear discomfort, air sickness, and oxygen want to a marked degree, as the statistics reveal. Thus considerable progress has been made for the benefit of the increasing numbers of commercial air travelers as well as for military personnel.

Discussion

Dr. Norton Canfield pointed out that groups investigating noise problems have come up with some valuable observations and suggestions. Cancellation of noise, however, is a thorny problem which merits and is receiving a great deal of attention.

The problems of life in a gravity-free medium suggest the possibility of the human being developing a substitute sense to compensate for the elimination of the equilibrium senses. Dr. Canfield inquired as to why cabin pressure is not increased at the moment of take-off.

Dr. John A. Bardley remarked that standards of measurement have changed because of the enormous increases in sound, speed, etc. Also he believes we will have to know more about speech adaptations to new environments. He drew a picture of man in his new orbit leaving much of it to speculation a la Buck Rogers!

Dr. Campbell replied to Dr. Canfield's query by stating that cabin pressures are gradually increased as the plane is taxying before take-off.

Homespun Laryngology.

Dr. Lyman Richards.

Dr. Richards referred to the traveler returning from a long arduous journey, whose chief complaint was "sand in his shoes." The situation is the same with the laryngologist in the case of patients seeking relief for symptoms unassociated with any visible pathologic signs. He mentions the frustration which comes over the sincere doctor seeking to explain the complaint in the absence of tangible objective findings. Laryngologists are exposed to this type of patient because a visit to the doctor does not involve time-consuming dressing and undressing, accessory examinations, and extensive laboratory and mechanical diagnostic procedures. Yet though the otolaryngological examination fails to disclose positive findings, the physician is haunted by the fear that he may have overlooked something very vital, as has occasionally happened when a malignancy turns up subsequently. The multiplicity of etiologic possibilities makes it incumbent on the examiner to be thorough and painstaking, and not to give way to the impulse of prescribing his favorite remedy for nondescript complaints, such as vitamins, diets, physiotherapy, or whatever his particular hobby may be. It involves the investigation of the patient as a whole, taking into consideration his environment, personality, heredity, domestic situation, etc. The separation of psychic and somatic symptoms requires patience, insight, and sympathetic understanding.

Discussion

Dr. Frederick T. Hill found himself in complete agreement with Dr. Richards in a consideration of this perplexing problem. Thoughtful physicians are always on the alert lest they fail to identify a true lesion in a patient whose symptoms

seem to indicate merely a functional disorder. The percentage of functional overlay varies in different specialties, as Dr. Hill discovered on polling the various departments at his hospital. It was as low as 10% in orthopedics and as high as 42% in internal medicine and cardiology. He finds that it is only through careful, painstaking history taking and scrutiny of every bit of evidence that can be elicited from the patient as to background and environmental factors that the true status can be established. This takes time and is inconsistent with the practice of seeing a large number of patients in a short space of time. It is the only point on which Dr. Hill took issue with the essayist, who mentioned seeing 30 to 40 patients a day.

Dr. Richards responded by stating that he had found in his tours about the country that many men had outstripped him in the numbers of patients seen in a restricted period of time, which was somewhat baffling. He wishes to emphasize one factor that seems to lead many men astray in obscure cases, namely, a tendency to follow a hobby, such as giving vaccines, altering the diet, or applying caustics to the turbinates. There are so many angles to this problem that often confuse and lead one astray. The main point of his argument is that one should never be put into the position of having overlooked a serious lesion, and this is a matter that conscientious physicians are ever bearing in mind.

Fundamental Physiological Factors to Be Considered in Speech Therapy. Dr. W. W. Wilkerson Jr. and Forrest M. Hull (by invitation).

Analysis of human speech production involves a consideration of several physiologic systems functionally integrated. In addition to the breathing mechanism, the larynx, and the resonators, a fourth factor is involved, namely, the articulators. Dr. Wilkerson showed how the latter, which are primarily concerned with more basic functions, are brought into play secondarily for the production of speech. A number of conditions are enumerated which may interfere with this function, thus affecting the production of speech. Among the conditions listed are brain damage, abnormalities of anatomical structures, lesions of various cranial nerves and central nervous system, etc. Several cases were presented to illustrate these points. Training and retraining in some of these cases may restore the normal mechanism, while in other cases compensatory movements may be developed to accomplish a greater or less degree of rehabilitation.

The Mechanism of Phonation. Sir Victor Negus.

Dr. Negus presented an analysis of the mechanism of phonation in which he refuted the theory recently advanced by some French authors to the effect that the vocal cords in phonation are activated by clonic contractures rather than being in a state of tonic contracture as hitherto held. This new theory holds that phonation at a certain pitch is the result of an equal number of stimuli from the higher centers. Dr. Negus refutes this argument by showing first that the fastest voluntary muscle known is in the wing of a fly which vibrates at the rate of 330 times per second. In his experience he knows of no human muscle capable of the same and he cannot conceive of the thyroarytenoids in this role. Besides, when one considers the higher pitches of over 2000 cps which are reached by many singing voices, the theory becomes more improbable. Furthermore, it has been proved in laboratory experiments that when the recurrent laryngeal nerve is stimulated by an electrical current the action potentials coming out of the muscle will correspond to the stimuli only at low registers, such as 50 to 60 per second. However, when the stimuli are stepped up to 250 and higher, the recorded potentials become irregular both in amplitude and in distribution. If the theory of clonic contractions were to be tenable, the output of potentials should correspond accurately to the rate of the stimuli.

Discussion

Dr. Louis H. Clerf confessed that he was somewhat confused by this theory, which to be clearly understood would have to be set forth in simpler terms. As for Dr. Wilkerson's presentation, he finds it of practical value because of his interest in the rehabilitation of the laryngectomized patient. The art of speech therapy is being developed to a stage where it is offering considerable relief to these handicapped persons, and gives promise of further development. He agrees with the essayist on the importance of good dentistry as a factor in the regulation of articulation. A case in point was a patient with a prominent torus palatinus, in which a denture covering the mass was less effective than one which permitted it to remain exposed.

Dr. Fred Dixon also recognized the valued service of the speech therapist in our field. The importance of good articulation and properly modulated voice cannot be overestimated when applied to persons who are in contact with the public through various communication channels. He feels that in many cases clearer tones can be obtained by raising the register, since he believes that the lower registers frequently tend to glottic trauma.

Concerning vocal nodules, he would ask Dr. Wilkerson whether he relies on surgery entirely or whether he recommends vocal therapy. Also as to

his advice to patients after removal of nodules in the matter of complete voice rest, use of a whisper, etc.

Dr. William J. McNally called attention to the great amount of research conducted by Sir Victor in the laboratory and in the zoo, which commands universal respect and sets him up as an authority. He would recommend that every laryngologist keep Dr. Negus' book on the "Mechanism of the Larynx" by his bedside for careful leisurely reading.

Dr. Wilkerson closed his portion of the discussion by stating that he does not rely on surgery alone for the relief of vocal nodules. In the early stages absolute voice rest and later vocal therapy may be very effective. If surgery is resorted to, the period of vocal abstinence depends on the degree of postoperative reaction and the healing process. He usually insists on voice rest for a month and whispered voice later.

Dr. Negus closed by regretting the absence of contradictory criticisms. However, he thought most of the members would like to give the matter some study before offering any opinion. He was grateful to Dr. McNally for his kind reference to his book, but pointed out that one physician had called his attention to the fact that it weighed 6½ lb., which would hardly be considered comfortable for reading in bed!

Malignant Lymphoma of the Pharynx. Dr. Stanton A. Friedberg, Dr. Robert H. Edwards, and Dr. George M. Hass.

Dr. Friedberg presented an analysis of 6 additional cases of malignant lymphoma of the pharynx which, added to the 10 cases previously reported, furnished the basis of the present study. It appears that "malignant lymphoma" embraces a variety of growths, including types of lymphosarcoma as well as Hodgkin's disease. It is difficult to classify these growths on a histologic basis because there appear to be transitions from one form to another. While the tumor may be localized for a long time, systemic involvement appears to be inevitable. Prognosis seems to be more dependent on the length of the remissions than on the histologic picture. Early systemic involvement usually means a rapid downhill progression. Longer remission (60, 56, and 52 months in three cases) implies longer survival. Of 15 determinate cases, 9 died of the disease, 3 are living without evidence of generalized disease although two of them are of recent date.

X-ray therapy and chemotherapy are effective in controlling the disease for varying periods of time, but apparently have no curative value.

Lesions in the pharynx such as abnormal or recurring lymphoid masses, unilateral tonsil hypertrophy, or unilateral smooth swelling of the pharynx should always arouse suspicion of malignant lymphoma.

Discussion

Dr. Alden H. Miller found 15 cases of lymphoma of the pharynx in the files of the Los Angeles General Hospital in a 10-year period. Eleven were diagnosed as lymphosarcoma, lymphocytic and lymphoblastic malignancies, and three as reticulum cell sarcoma. One-third of the patients died within two and a half years; three were free of symptoms after five years. Nitrogen mustard relieved pain but did not halt the progress. Dr. Miller emphasized the importance of obtaining a large block of tissue for histologic examination, since needle or punch biopsies do not furnish enough tissue for thorough study.

Dr. John B. Erich agreed that these various types of neoplasm must have a common origin. A review of the material in the files of the Mayo Clinic reveals a total of 171 cases of malignant lymphomas of the pharynx in which the diagnosis was lymphocytic sarcoma in 76%, reticulum cell sarcoma in 19%, Hodgkin's disease in 5%, and giant follicular lymphosarcoma in 1%. They found lymphoblastoma to be very malignant, and reticulum cell sarcoma very resistant to irradiation. External irradiation is effective at least in halting the process in most cases, and is superior to seeding, which was formerly employed. The prognosis, however, is bad, and it is impossible to predict the duration of the disease.

Dr. Friedberg in closing, found it interesting that Dr. Miller had encountered almost the exact number of cases in the same period of time. While agreeing that the reticulum-cell sarcomas are generally thought to be the most malignant, it was nevertheless surprising to note that some of his cases in this category survived the longest. This contrasted remarkably with other cases where the growths were more mature, and yet the survival periods much shorter. It is therefore quite evident, as Dr. Erich pointed out, that one cannot predict the outcome just from the histologic appearance of the tissue. The problem is still more confusing when occasionally a pathologist viewing the same specimen at intervals will render conflicting opinions. Another difficult matter, as mentioned by Dr. Miller, is the distinction between response to infection and hyperplasia. He has seen cases diagnosed as hyperplasia of lymphoid structures who were dead in six months from disseminated lymphoma.

Regarding different types of which Dr. Erich spoke, the author seemed to think that classification all depended upon the particular pathologist's training and his concept of the disease. Interpretation seems to vary widely in different communities.

The unpredictability in these cases was well represented by a 96-year-old man with a follicular type of growth considered more benign but who succumbed more rapidly, whereas the more malignant reticulum-cell growths in some cases survived the longest.

The Role of Rhinology in Pituitary Surgery. Dr. Oscar Hirsch (by invitation).

Dr. Hirsch gave the history of the intranasal approach to the pituitary gland, culminating in his trans-septal technique, which he has employed since 1910 in approximately 350 cases. Prior to 1938 (preantibiotic era) 277 patients were operated upon, with a mortality of 5.4%. During the antibiotic era (1944 to 1957) 75 operations were performed, with only one death. Of these patients 35 are living or have lived for five years or more, 24 of them with lasting improvement.

Supradiaphragmatic tumors are not amenable to this technique.

Intrasellar growths, recognized by expansion of the sella, are ideal for the trans-septal operation.

Tumors which are both supra- and intrasellar are the most frequent type encountered and can be operated on via the septum, although only the intrasellar portion is accessible. Since there is no other method of attacking this type of growth, the Hirsch operation offers at least some hope of relieving the optic pathways of strangulation. The postoperative use of radium has been of great help in retarding further growth.

Discussion

Dr. Shirley Baron related a case of pituitary cyst in a 53-year-old woman, in which the cyst was evacuated via Dr. Hirsch's approach and a radiopaque solution injected which outlined it clearly. Co^{60} was introduced within the cavity, and the patient's vision returned. However, after seven months blindness recurred in one eye. The cyst was again incised, but no fluid was found. A year later the other eye became blind. Dr. Baron speculated on the possibility of the damage having resulted from overexposure to the cobalt.

Dr. Francis L. Weille called attention to one item which Dr. Hirsch omitted to mention, namely, the low mortality in his series (only 1%) as compared with the mortality of 30% from the transcranial approach. In his clinic all of these cases are not seen by Dr. Hirsch along with the endocrinology group.

Dr. Robert C. McNaught stated that they had done around 15 of these cases at Stanford, and that the ophthalmologists and the Tumor Board refer them routinely to his department. They recently employed Hirsch's technique for the removal of a normal pituitary in a case where the object was to produce the effect of a complete adrenalectomy. It was accomplished despite the fact that it is more difficult when the posterior wall of the sphenoid is normal instead of being thinned out by pressure of the growth.

Dr. Hirsch expressed his appreciation of the attention given his technique by the San Francisco group. He credits the late Dr. Lewis Morrison, who became interested after seeing Dr. Hirsch and invited him to lecture on the subject at a meeting of the Pacific Coast Society. In Boston, Dr. Schall has also been most cooperative in this respect.

Replying to Dr. Maxwell, Dr. Hirsch would like to dispel any fear of danger in this operation. With a good knowledge of the anatomy any good rhinologic surgeon should be able to accomplish it without too much training.

Dr. Hirsch stated that he would not recommend the operation for a normal gland. He believes this is more properly in the realm of neurosurgery. This also applies to the supradiaphragmatic tumors which belong to the neurosurgeon. However, the growths that are below the diaphragm, the cases with hemianopsia and atrophy, are definitely in our field. As for cortisone, he sees no need of it since there is very little shock in these cases. Also, the danger of hemorrhage is minimal.

Medical and Surgical Misadventures. Dr. Francis L. Lederer.

Dr. Lederer presented a broad analysis of the many factors which may lead to misadventure in the practice of otolaryngology. From the very first contact with the patient, the physician passes through the various stages of history taking, general appraisal of the patient, examination and therapy, each of which is fraught with pitfalls into which the unwary may fall. In addition, many errors are due to preconceived notions, partiality to certain types of therapy, and individual hobbies which may or may not fit the case. Furthermore, surgical risks add to the possibilities of error and misadventure.

The list of items elaborated by Dr. Lederer is formidable, and it all adds up to the physician himself, his temperament, education, patience, perspicuity, thoroughness, and skill.

Books

Surgery of Head and Neck Tumors. By Hayes Martin, M.D., Attending Surgeon, Memorial Hospital; Associate Professor of Clinical Surgery, Cornell University Medical College. Price, $18.50. Pp. 430, with 598 illustrations. Paul B. Hoeber, Inc. (medical book department of Harper & Brothers), 49 E. 33d St., New York 16, 1957.

Dr. Martin has dedicated his book "to Jules C. Abels, the best doctor, and Joseph J. Lerner, the most courageous patient I have ever known." . . . One hopes that these gentlemen are still alive to enjoy such praise.

At the outset, 10 pages are devoted to "Contents." Part I takes up Basic Principles of Cancer Surgery of the Head and Neck. Beginning with a few pages of historical notes, preoperative considerations are next in order. Then come "The Operation," with technical considerations such as shaving and sterile preparation of the field, local or general anesthesia, instruments, types of incision, blood transfusions, how much to excise, preliminary tracheotomy when necessary, closure of wounds, sutures, skin grafts, bone grafts, wound drainage, etc. . . . Chapter 4 gives some eight pages to postoperative care. Chapter 5 describes the immediate postoperative risks and disabilities due to removal of diseased tissues and organs. Complications such as hemorrhage, chyloma, and emphysema occupy Chapter 6. Chapter 7 has to do with cosmetic and functional disabilities, with notes on speech defects, and the voice after total laryngectomy. At the end of this descriptive text, there are some eight pages of bibliography and references to the literature which show how exhaustive this undertaking has been in the effort to be thorough and complete.

Part II is an atlas of operative procedures. The illustrations are works of art—none in color, to be sure, but nevertheless detailed, comprehensive, and in many instances resembling engravings. About 40 pages are given over to dissection of the neck, with methods of closing or covering defects after removal of diseased tissues. Mandibular resection with replacement by bone grafts, and technique for removal of the tongue in part or whole are well illustrated. The various procedures used in subtotal or total removal of the larynx are well pictured, and credit is given to other surgeons who have devised special techniques which are of value.

Appendix A gives a list of instruments to guide the O. R. nurse in preparation for head and neck surgery. Appendix B outlines the resident surgeon's report and record of the case in hand. A satisfactory index, six pages, ends this excellent contribution to an expanding surgical field.

Noise and Your Ear. By Aram Glorig Jr., M.D., Director of Research, Research Center of The Subcommittee on Noise in Industry, Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology, Los Angeles. Price, $6.50. Grune & Stratton, Inc., 381 Fourth Ave., New York, 16, 1958.

The author of this excellent monograph is a pioneer in the field of occupational deafness and has crystallized his experience so that it is now available to everyone. Although the book has only 145 pages it covers practically every aspect of the effects of noise upon hearing. It serves as an unusually fine reference book for all people interested in this work and provides sources for further reading. The 14 chapters are divided into sections, each of which is complete unto itself, covering its designated topic. This allows the reader to acquire a good perspective of whatever aspect he may desire.

Many excellent features are in evidence. Dr. Glorig answers many of the important questions which always arise in discussing occupational deafness. He does so with preciseness and authority and yet with evident appreciation that much information is still necessary to give complete answers.

Much of the material in the book is based on personal experience and investigation and represents the foremost thoughts on the subject. A good bibliography, index, and comment on organizations active in the work are also included.

This book by so competent an author should be well received, for it is authoritative, well written, and contains important information for all those involved in the field of occupational deafness.

Tumor Surgery of the Head and Neck. By Robert S. Pollack. Price, $5.00. Pp. 101, with 112 illustrations. Lea & Febiger, 600 S. Washington Sq., Philadelphia 6, 1957.

This is a "West Coast book," since the author is well connected with some of the best-known hospitals in California, and is a teacher in Stanford and the University of California. Throughout, it is clinical, and therefore practical, clarifying diagnostic problems, and stating reasons for choice of management. . . . Recurrent cancer always makes problems: what to do, when, and how. Is it best to do surgery or irradiation? Use of isotopes and chemotherapy calls for "agonized reappraisal" of each case problem. The author aims to help in making such decisions, and gives a feeling of stand-by to the anxious and not greatly experienced operator. Here is an inexpensive vade mecum which should have a wide field of usefulness.

News and Comment

ANNOUNCEMENTS

American Board of Otolaryngology.—Only one examination will be conducted by the American Board of Otolaryngology, and this will be Oct. 6-9, 1958, in Chicago, at the Palmer House.

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Directory of Otolaryngological Societies *

FOREIGN AND INTERNATIONAL

Canadian Otolaryngological Society
(Société Canadienne d'Otolaryngologie)

President: Dr. Robert T. Hayes, 42 Cobourg St., St. John, N. B.
Secretary: Dr. Donald M. MacRae, 34 Spring Garden Rd., Halifax, N. S.

Venezuela Otorhinolaryngology Society

President: Dr. Alfredo Celis Pérez.
Secretary: Dr. Jesús Miralles.

International Association of Allergology

President: Dr. Samuel M. Feinberg, 303 E. Chicago Ave., Chicago 11.
Secretary-General: Dr. José Quintero Fossas, Paseo 313, Vedado, Havana, Cuba.
Meeting: Third International Congress of Allergology.
Place: Paris. Time: Oct. 19-26, 1958.

International Bronchoesophagological Society

President: Dr. Jo Ono, Tokyo.
Secretary: Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40.
Meeting: Seventh International Congress of Bronchoesophagology.
Place: Kyoto, Japan. Time: Sept. 12-14, 1958.

International College of Surgeons, Section of Ophthalmology and Otolaryngology

President: Dr. E. G. Gill, 711 S. Jefferson St., Roanoke, Va.
Secretary-Treasurer: Dr. Louis Savitt, 3403 W. Lawrence Ave., Chicago 25.

International Congress of Audiology

General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Netherlands.
Place: Leyden, Netherlands.

International Course in Paedo-Audiology

General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Netherlands.
Place: Groningen, Netherlands.

Pan-American Association of Oto-Rhino-Laryngology and Broncho-Esophagology

President: Dr. José Gros, Havana, Cuba.
Secretary: Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40.
Meeting: Sixth Pan-American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology.
Place: Rio de Janeiro, Brazil. Time: Aug. 10-16, 1958.
President of Congress: Prof. R. David de Sanson.
Secretary of Congress: Dr. Walter Benevides, Caixa Postal 2838, Rio de Janeiro.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Alden Miller, 500 S. Lucas Ave., Los Angeles.
Secretary: Dr. Hugh A. Kuhn, 112 Rimbach St., Hammond, Ind.

American Academy of Ophthalmology and Otolaryngology

President: Dr. LeRoy A. Schall, 243 Charles St., Boston.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100-1st Ave. Bldg., Rochester, Minn.
Annual Meeting: Palmer House, Chicago, Oct. 12-17, 1958.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

American Board of Otolaryngology

President: Dr. Gordon D. Hoople, 1100 E. Genesee St., Syracuse 10, N. Y.
Secretary-Treasurer: Dr. Dean M. Lierle, University Hospitals, Iowa City.
Place: Palmer House, Chicago. Time: Oct. 12-17, 1958.

American Broncho-Esophagological Association

President: Dr. Walter Hoover, 605 Commonwealth Building, Boston.
Secretary: Dr. F. Johnson Putney, 1719 Rittenhouse Sq., Philadelphia 3.
Place: The Homestead, Hot Springs, Va. Time: March, 1959.

American Laryngological Association

President: Dr. Fred W. Dixon, 1027 Rose Building, Cleveland.
Secretary: Dr. James H. Maxwell, University Hospital, Ann Arbor, Mich.
Place: The Homestead, Hot Springs, Va. Time: March 8-9, 1959.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Lawrence R. Boies, University Hospital, Minneapolis 14.
Secretary: Dr. C. Stewart Nash, 700 Medical Arts Bldg., Rochester 7, N. Y.
Place: The Homestead, Hot Springs, Va. Time: March, 1959.

SECTIONS:

Eastern.—Chairman: Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40.
Southern.—Chairman: Dr. Sam H. Sanders, 1089 Madison Ave., Memphis, Tenn.
Middle.—Chairman: Dr. Francis L. Lederer, 860 N. Lake Shore Drive, Chicago.
Western.—Chairman: Dr. Ben. R. Dysart, 960 E. Green St., Pasadena 1, Calif.

American Rhinologic Society

President: Dr. Russell I. Williams, 408 Hynds Bldg., Cheyenne, Wyo.
Secretary: Dr. Robert M. Hansen, 1735 N. Wheeler Ave., Portland, Ore.
Annual Clinical Session: Illinois Masonic Hospital, Chicago, October, 1958.
Annual Meeting: Chicago, October, 1958.

American Otological Society, Inc.

President: Dr. Moses H. Lurie, 483 Beacon St., Boston.
Secretary: Dr. Lawrence R. Boies, University Hospitals, Minneapolis 14.
Place: The Homestead, Hot Springs, Va. Time: 1959.

American Otorhinologic Society for Plastic Surgery, Inc.

President: Dr. Armand L. Caron, 36 Pleasant St., Worcester, Mass.
Secretary: Dr. Joseph G. Gilbert, 75 Barberry Lane, Roslyn Heights, N. Y.

American Society of Facial Plastic Surgery

President: Dr. Trent W. Smith, 327 E. State St., Columbus 15, Ohio.
Secretary: Dr. Samuel M. Bloom, 123 E. 83rd St., New York 28.
Meeting: July 16, 1958, New York.

American Society of Ophthalmologic and Otolaryngologic Allergy

President: Dr. Joseph W. Hampsey, Grant Building, Pittsburgh 19.
Secretary-Treasurer: Dr. Daniel S. DeStio, 121 S. Highland Ave., Pittsburgh 6.
Place: Palmer House, Chicago. Time: Oct. 16-17, 1958.

Otosclerosis Study Group

President: Dr. Lawrence R. Boies, University Hospital, Minneapolis.
Secretary-Treasurer: Dr. Arthur L. Juers, 611 Brown Building, Louisville.
Place: Palmer House, Chicago. Time: Oct. 11, 1958.

Society of Military Otolaryngologists

President: Capt. William C. Livingood, U. S. N. (MC).
Secretary-Treasurer: Lt. Col. Stanley H. Bear, USAF(MC), 3810th USAF Hospital, Maxwell AFB, Alabama.

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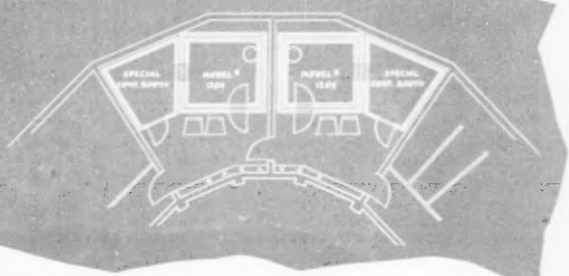

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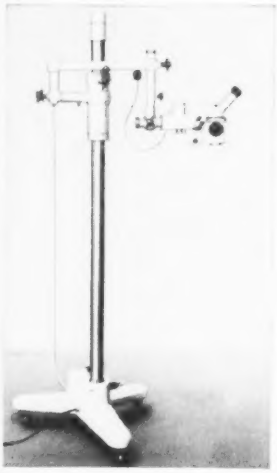

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